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ABSTRACT

The problems associated with the transition from the secondary level to the tertiary level in education have given rise to many surveys, analyses of statistics, research projects, reports and literature reviews. Much has been written on topics such as testing, selection, prediction and wastage, with findings and conclusions which appear to have varying degrees of relevance to contemporary problems in Victoria. This literature review does not attempt to discuss or even list every article ever published in this area. It does attempt to define a limited area in terms of those aspects which seem more relevant to the circumstances of the present problem. Some early studies are discussed in relation to the changing perspectives and the historical developments in methods of analysis and suggested solutions. Overseas studies have been selected when their findings have been general and transferable to the current Victorian situation, or when they have appeared to influence other important investigations. Although some non-congnitive studies are reviewed, the general emphasis is on studies dealing with cognitive factors in testing and selecting. (Author/RC)

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TESTING FOR STUDENT SELECTION AT TERTIARY LEVEL

a literature review

W McDonell

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AUSTRALIAN COUNCIL FOR
EDUCATIONAL RESEARCH
IN ASSOCIATION WITH
TERTIARY EDUCATION ENTRANCE PROJECT,
VICTORIA

TERTIARY EDUCATION ENTRANCE PROJECT

TESTING FOR STUDENT SELECTION AT TERTIARY LEVEL:

A LITERATURE REVIEW

W. McDONELL

AUSTRALIAN COUNCIL FOR
EDUCATIONAL RESEARCH

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INTRODUCTION

The problems associated with the transition from the secondary level to the tertiary level in education have given rise to many surveys, analyses of statistics, research projects, reports and literature reviews. During the last half-century there have been considerable changes in attitudes to education, availability of tertiary education and the role of education in our society generally. Problems of quotas and selection of students for tertiary institutions were once regarded as temporary measures associated with the crises of World War II and the years immediately following it. A vast expansion in the numbers of institutions, courses and places available to students has not only failed to solve the problem, but it has made the problem larger and more complex. This is not just a local phenomenon. The problem exists in similar forms in many countries of the world and the elaborate machinery and processes being set up to deal with it (such as the Victorian Universities Admission Committee) give the appearance of resignation to a prolonged, if not permanent, situation.

Although selection and quotas are associated with short supply and high demand in tertiary education, there are some aspects of the problem, such as success and failure, wastage of students and ability to predict likely success which are not necessarily associated with this situation. Sanders (1958*a*) points out that the early surveys on these topics were published before World War II. A Scottish university survey of ability, success and failure, published in 1937 (*The Prognostic Value of University Entrance Examinations in Scotland*, 1937) and an American investigation into student wastage in 25 universities, published in 1938 (McNeely, 1938), were both retrospective studies taking as their base years 1928 and 1931 respectively.

Since that time, much has been written on topics such as testing, selection, prediction and wastage, with findings and conclusions which appear to have varying degrees of relevance to contemporary problems in Victoria. This literature review does not attempt to discuss or even list every article ever published in this area. It does attempt to define a limited area in terms of those aspects which seem more relevant to the circumstances of the present problem. Some early studies are discussed

in relation to the changing perspectives and the historical developments in methods of analysis and suggested solutions. Overseas studies have been selected when their findings have been general and transferable to the current Victorian situation, or when they have appeared to influence other important investigations. Although some non-cognitive studies are reviewed, the general emphasis is on studies dealing with cognitive factors in testing and selecting.

CHAPTER ONE

GENERAL BACKGROUND

During the nineteenth century, most universities conducted their own entrance examinations. By the early years of this century, bodies such as the College Entrance Examination Board in the USA and the Joint Matriculation Board and similar authorities in Britain were established to co-ordinate the selection of students for tertiary institutions. Yet, apart from producing the two reports mentioned in the Introduction, none of these bodies was concerned with systematic analysis of selection during the years before World War II. Most of the early analytical investigations into testing for selection at tertiary level were prompted by the impact of the war years and the post-war problems on the education system.

However, one pre-war study had particular relevance for Australia. It was commenced in 1935 by the New Zealand Council for Educational Research for the University of New Zealand. The report (Thomas, Beeby and Oram, 1939) contains much that is still relevant to our situation today. For example, a major criticism was that the University Entrance Examination had become a general school-leaving certificate, thus forcing on post-primary schools curricula and methods of teaching unsuitable for most students. At the same time, university teachers complained that the standard of the Entrance Examination was too low. This report set the problem in its historical context and discussed the changing attitudes towards the Entrance Examination of the University, schools, employers and the medical profession. Based on a follow-up study of the students who passed the University Entrance Examination in 1926 and 1927, this investigation produced findings on prediction of academic success which are not very different from those of the more recent studies. These findings and the recommendations will be discussed further in Chapter 3.

The historical background to the College Board Admissions Testing Program in USA is given in Angoff (1971). Although the book contains a section on the predictive validity of the tests, it is not primarily concerned with the problem of success or failure at tertiary level.

'College Student Mortality' (McNeely, 1938), the report of a research project carried out by the United States Office of Education in 1936–37, revealed that only 31·6 per cent of students graduated at the end of the normal four-year period, although it was estimated that about 55 per cent would graduate eventually. This figure of 31·6 per cent for graduating students is comparable with 35 per cent in the New Zealand study which was going on at about the same time.

There were no similar studies undertaken for Australia as a whole, but the introduction of an accrediting system for some schools in Victoria in 1913 gave rise to a few early reports. The public examination system continued for those schools not approved for accreditation and this dual system provided the basis for some comparisons of performance between students who had qualified by the two different methods (Hansen, 1928; Cherry, 1930; Seitz, 1932). Not only was the reliability of the accrediting system questioned, but also the variability of results in the Public Examinations which was revealed by Seitz in his very thorough analysis covering the years 1922–33 (Seitz, 1936).

Some early studies on student wastage in particular Australian universities are summarized in the first research report published by the Commonwealth Office of Education (Sanders, 1948, Ch. 1). In the University of Western Australia an analysis of student wastage in the faculties of Arts, Science, Engineering, Law and Agriculture gave overall rates of 22 per cent graduating in minimum time and 49 per cent by the end of eight years from the time of first enrolment. This survey looked at the groups enrolling between 1930 and 1939, but the eight-year survival rates must have been based on only the first few years of this period as the report was published in 1942. In the same year, the University of Melbourne published similar figures for the 1934 intake in Arts and the 1932–35 admissions to Medicine. The Arts figures showed that the minimum time graduation rate was only 18 per cent and it rose only to 43 per cent by the end of eight years from first enrolment. In Medicine, 48 per cent graduated in minimum time and 77 per cent had graduated up to the date of the inquiry. The differences in these figures are even more surprising when it is realized that most of the Arts students were taking a three-year course, while the course in Medicine took six years.

The only study from the University of Sydney quoted by Sanders is also one of the Faculty of Medicine, where the 1939 intake of 161 students produced a minimum time graduation rate of 46 per cent. This appears to be comparable with the earlier Melbourne figure of 48 per

cent. However, another Melbourne study of 155 students admitted to the Faculty of Medicine, also in 1939, produced a minimum time graduation rate of only 34 per cent. These two studies also produced separate data on survival rates of first-enrolment students and students repeating first-year Medicine in 1939. In both cases, the repeating students showed much poorer results than did the first-enrolment group.

Even these early investigations showed up the complexity of the problem in Australia. It was not possible to generalize about failure rates, as these varied not only between universities and between faculties within each university, but also within one faculty over a period of time. Later figures for technological faculties, which were made available to the Universities Commission for research purposes during the war, showed similar fluctuations, but some of the variations from year to year could be explained in terms of changing policy during wartime (Sanders, 1948, p. 16).

Another complicating factor in these pre-war studies was the large number of students undertaking either part-time study or external studies. The universities of Melbourne, Adelaide, Queensland, Western Australia and Tasmania all had external students and in 1939 only 37 per cent of students enrolled in the University of Western Australia were full-time. When the graduation rates for part-time and external students were analysed separately these students were found to be far less successful than full-time students. The Western Australian study had shown that the graduation rate rose in the depression years of 1930–35 when the drop in part-time enrolments was far greater than that in full-time enrolments. Between 1935 and 1939 the numbers of part-time students increased rapidly and the overall graduation rate fell.

This early report by the Commonwealth Office of Education (Sanders, 1948) is outstanding for the historical perspective it provides to the problems of selection and success. It summarizes the variety of examinations and matriculation requirements in each state and, in particular, discusses the change in Victoria in 1944 from a combined system of accrediting and public examining at Leaving Certificate level to the externally controlled Matriculation Examination. The effects of prerequisites for some courses on student intake and secondary schooling are also investigated. The analysis of prediction of academic success, based on matriculation examination results, not only produces correlation coefficients comparable with those produced in more recent studies, but raises several important statistical problems which place

limitations on the value of correlation coefficients obtainable from this data. The correlation coefficients were not high enough for individual prediction from matriculation results to performance in first year at university. Correlation between matriculation results and higher years at university were even lower and the best evidence of success in later years of study was provided by the examination results in first year.

This report, published soon after World War II, appears to be one of the first to study the effect of war-time selection on the composition of the student body in terms of academic quality, socio-economic background, sex, geographic area of home or type of secondary school attended. It was clear that, for the middle and lower classes, there had been a shift in educational opportunity at the tertiary level, but the proportion of the population attending a university was still considered low by comparison with other English speaking countries such as Scotland, New Zealand and the United States.

Sanders continued his interest in the problems of student selection long after he had completed this report for the Universities Commission and the Commonwealth Office of Education; his name dominates the literature for the next decade or more. Three articles (Sanders 1953, 1957, 1958*b*) which appeared over the next few years reiterated the main conclusions of the earlier report, but each time the research findings both within Australia and from overseas were brought up to date. The first article was largely a bibliographical review, while the second one attempted to place the problem in its historical context and raise some of the philosophical issues associated with university selection. The third article is really a summary of another major report (Sanders 1958*a*) in which the research on academic wastage and failure over the years 1928 to 1958 is reviewed. This report again covers some of the earlier findings, but much of it is concerned with the post-war years. However, the major post-war study of the 1947 intake of students in the University of Western Australia was not included. A separate report was compiled in 1959 and subsequently appeared in book form (Sanders, 1961). As both the 1958 report and the 1961 book illustrate the changing nature of the problem in the post-war period, they will be referred to in greater detail in Chapter 2, but Sanders has produced enough evidence of earlier studies to show that student failure and so-called 'wastage' at universities were matters of concern long before the war. This problem did not originate in the 1950s even though much of the more recent work seems to have been prompted by the Murray Commission Report of 1957 (Murray Report, 1957).

If the situation was too complex for generalizations to be made across Australia, then generalizations were even less likely to appear in England. *From School to University* (Dale, 1954) sets out the variety of qualifications, prerequisites and selection procedures relevant to individual universities in Britain. In the pre-war years, there appears to have been little attention paid to the prognostic value of the various qualifying examinations as, apart from Oxford, Cambridge and the Medical schools, almost all who passed these examinations and applied for admission were accepted. Dale saw finance as the principal selector, not only at the point of university entrance, but as early as the Secondary Grammar School Entrance Examination.

The widespread use in Britain of testing for selection for secondary education gave rise to investigations in this context of many issues which have been more recently associated with selection at tertiary level. For example, a major Scottish report of this period, *Selection for Secondary Education*, describes itself as 'a scientific study of certain problems of selection and guidance that arise at the first big sifting of the material in an educational system' (McClelland, 1942, preface xi). This report discusses standardization of tests, reliability of tests and examinations, teachers' estimates, correlation with later performance, predictive value of measures, different approaches to the selection problem, statistical techniques and some associated difficulties. Much of the methodology of this study was applicable to the later investigations at the secondary–tertiary interface.

The committee responsible for this report was the Scottish Committee in the International Examination Inquiry and the report represents the completion of the tasks undertaken by the Scottish Delegation at the first International Conference on Examinations in 1931 (Monroe, 1931). This same conference gave rise to a now well-known report from the English Committee, *An Examination of Examinations* (Hartog and Rhodes, 1935). This report, which was presented to the second International Conference in 1935, studied the reliability of experienced examiners at both School Certificate and university examinations. The reliability varied from subject to subject but, in general, it was very poor. It was possible for some candidates to be so misplaced on the marks list that the injustices would not even be picked up in the consideration of borderline cases. Furthermore, the same examiners marking the same scripts after an interval of a year changed the classifications of Pass, Fail or Credit on 92 of the 210 scripts These results were very disturbing in a system which rested so

heavily on examinations, but the report did not suggest that examinations should be abolished. It called for careful and systematic experiments aimed at improving examinations and removing the uncertainties of the existing system.

Concern about examinations, their uses and their sociological implications was also expressed by members from France, Germany, Switzerland and United States at the 1931 Conference, although the problem of testing for selection seems to have been related to selection for the Civil Service and similar vocations, rather than for admission to universities. The use of examinations for sifting and selecting was seen as a traditional process whereby an individual's social stratum and social status in adult life were determined. By the time the point of entry to university was reached, most of the selecting had already been done. It was the growing demand for tertiary education after World War II which made this additional level of sifting necessary.

By 1959, the problems associated with selection for tertiary education were so widespread that the United Nations Educational, Scientific and Cultural Organization and the International Association of Universities agreed to undertake jointly a research programme on access to higher education. This study, carried out during the years 1960–62, took two different approaches to the problem. One was a very comprehensive analysis based on such sources as UNESCO, United Nations and a questionnaire on admissions operations to approximately three hundred institutions of higher education in some eighty countries. The second approach was a very specific and detailed study of the problem in twelve countries, namely Brazil, Chile, France, India, Japan, Union of Soviet Socialist Republics, United Arab Republic, United Kingdom (England and Wales), United States of America, New Zealand, Senegal and the Republic of South Africa. The reports of these national studies are contained in Volume II of the report (*Access to Higher Education*, 1965) and the generalizations drawn from them are contained in the more comprehensive report in Volume I (Bowles, 1963).

The observation made by Dale almost a decade earlier (Dale, 1954), that selection for tertiary education was a process which started much earlier in the student's educational life, was apparently not unique to the English system. This international study concluded that selection for admission to higher education was a process which extended over a period of years and a series of selections in order to determine which students would continue towards the goal of ultimate entry to higher education. The report discusses problems which have arisen in this

process in the decade of the 1950s as a result of changes in social, economic and political life as well as changes in technology and manpower utilization. Associated with these changes we see increasing demand for educational opportunity, new forms and structures of education, new patterns of student movement at the secondary–tertiary interface and new forms of the selection process. There has been a trend towards abandonment of selective examinations for secondary school entrance, but an increase in selection procedures at the point of entry to tertiary education. However, in some countries, the development of a broad, common secondary school curriculum which permits students to choose from a wide range of educational goals, is seen as helping to shift the emphasis from control of student movement by examination to control by orientation or guidance services.

Although Australia was not one of the twelve countries featured in this study, the report gives an excellent background of world developments against which we can look at the changes which took place in Australia during that same period.

CHAPTER TWO

WORLD WAR II AND THE POST-WAR YEARS: CHANGING PERCEPTIONS IN AUSTRALIA

While discussions about minimum standards for entrance and the suitability of these for selecting those students who might succeed at university had been interesting academic debates in peacetime, the advent of World War II turned these issues into real-life problems. By the end of 1942, wartime powers vested in the Commonwealth Government gave it control over manpower. Decisions had to be made about whether students should be exempted from duty in the armed forces and other forms of national service. This resulted in the faculties of Medicine, Science, Engineering, Dentistry, Agricultural Science and Veterinary Science being declared 'reserved' faculties with quotas imposed on their intake. These quotas were largely determined by the numbers of students admitted in 1939. Students who were admitted under this quota system between 1943 and 1945 were declared to be in a reserved occupation and became eligible for financial assistance, as the continued output of graduates from these faculties was considered an essential part of the war effort. This was the beginning of both competitive selection which excluded some qualified applicants and living allowances for students in Australian universities. These events and their effects on student selection are described in great detail by Sanders (Sanders, 1948, Ch. 10).

With this rising demand for graduates and the expenditure of Commonwealth Government money in student allowances, attention was focussed on the output of the universities. The war effort demanded increased efficiency from all sectors of the community and 'wastage' in universities became a matter for government concern. The living allowances, which were subject to a means test, brought the university within the reach of more students and the competition for admission increased. Hence there was considerable pressure on the universities to improve their selection techniques in order to ensure that those selected had the maximum probability of graduating in minimum time.

In discussing this problem of prediction of academic success, Sanders

(1948, Chs 5 and 6) described the complex selection process extending over several years of the student's life which was influenced by both economic and environmental factors. This produced a highly selected sample and any attempt to correlate success in first-year university examinations with School Leaving examination results was limited by the restriction of the sample to only those who were admitted to university. Correlation coefficients varied from subject to subject and between faculties, but ranged between 0·50 and 0·80. For the Leaving Examination and later years in the university the correlation coefficient dropped to 0·45. Sanders did not consider these good enough for individual prediction as a correlation coefficient of 0·45 gave an improvement over chance of only 11 per cent. Even with a coefficient of 0·80 the improvement was only 40 per cent.

Other factors likely to affect accuracy of individual prediction were poor reliability of examination marks in both the Leaving Certificate and university examinations and the non-academic factors relevant to student performance. However, in spite of all these difficulties, Sanders argued that the students selected in 1943 and 1944 were of a higher calibre academically than those selected in 1939, but the pass rates in first-year university subjects did not rise accordingly. The statistics he produced seemed to suggest that this was so, but there was an underlying assumption that higher scores in Leaving Certificate indicated a higher academic level. This would only have been true if the standard had remained constant over the years 1939 to 1944 and, since the population of students entering for the Leaving examinations changed in size and possibly also in composition during those years, there may well have been a shift in standards. Nevertheless, the composition of the university intake also changed during those years and, after analysing the first-year results in scientific faculties of the universities of Sydney, Melbourne and Adelaide, Sanders concluded that there appeared to be a tendency to pass about the same proportion of students each year. This constancy of pass rate was seen to be a possible difficulty for those attempting to improve graduation rates by improving selection and entrance quality (Sanders, 1948, p. 125).

Another approach to the selection problem which was investigated during wartime was the use of intelligence test scores, either in place of School Leaving results or in conjunction with them (Sanders, 1948, Ch. 7). Sanders reported some findings from the University of Western Australia where an experimental study had involved giving an intelligence test to all intake students since 1935, but the test used was not a

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standardized one and the data obtained did not enable the calculation of intelligence quotients for comparison with the total population. However, correlation coefficients between these intelligence test scores and first-year university examination results were calculated and found to be significantly lower than those between Leaving Examination scores and first-year university results. A similar result was also obtained when a full-scale testing program was carried out at Melbourne University in 1943 and 1944.

This latter investigation was carried out by the Australian Council for Educational Research at the request of the University of Melbourne and the Commonwealth Universities Commission. It was a longitudinal study following the progress of the 1943 and 1944 intakes and the reports were not published until 1951 (for the Faculty of Arts) and 1955 (for the scientific faculties), although some interim results were given in an article published in 1949 (Hohne, 1949, 1951, 1955). The 1943 and 1944 students had been selected on the basis of their School Leaving Examination results. On entering the University of Melbourne in 1943 all 753 first-year students were given a battery of tests including the ACER Adult Test B40. Although the battery of tests was modified for the 939 first-year students in 1944, it still included the B40. This test gave IQ scores for the students, but the predictive value of these was even lower than that of the School Leaving results. This result was disappointing because one of the aims of this study was to investigate possible alternatives to the School Leaving Examination which could be used for selecting adult entrants, particularly ex-service personnel seeking university admission at the conclusion of the war. It was also hoped that some combination of School Leaving results and these other test scores would produce better predictive value than School Leaving alone, but the results indicated that, although some combinations did produce slightly higher correlation coefficients, they were unlikely to produce the more effective selection being sought in wartime.

In the Introduction to the Arts Faculty Report, Hohne raises the question of the limitations on a correlational study of this kind caused by the selection process. While it was possible to check the accuracy with which any selection process selected those likely to succeed, it was not possible to check the accuracy with which it rejected those who appeared to be unlikely to succeed. As these students were never admitted to the University, it was not known whether they would have succeeded or not. Furthermore, the correlation coefficients between actual examination scores were so low that it would have been impossible

to predict university results accurately for individual students. The best that could be produced was some sort of actuarial statistic associating chance of success or failure with a particular band of scores in the School Leaving Examination. For this reason the emphasis in the analysis of data shifted away from the use of refined statistical techniques towards simpler methods involving coarser groupings of scores. This produced results which were seen as potentially useful as part of the process of sifting students, not by examination scores alone, but by using those scores to indicate what guidance and advice should be offered to the student (Hohne, 1951, pp. 4–5).

Hohne concluded that university students, however selected, constituted an above average group in terms of IQ scores. It appeared that the series of scholastic examinations leading to entry into the University had this selective effect and any student who passed successfully through secondary school should be intellectually capable of passing through the University. The data suggested that there was a minimum level of intelligence which was a necessary, but not sufficient, condition for success. Moreover, above this minimum score, high level of success at the University did not seem to depend on either high intelligence or high entrance score (Hohne, 1949, pp. 39–40).

In the later report on the Faculties of Science, Engineering, Medicine, Dentistry and Agriculture, Hohne found no evidence which conflicted with the conclusions drawn in the earlier report on the Arts Faculty. However, he did find significant differences in graduation rates for the different faculties. Medicine and Dentistry appear to have responded to the more selective intake and the expectations of the University for improved graduation rates. By contrast, Science and Engineering graduated a smaller percentage in minimum time from the better qualified 1944 entrants than they did from the 1943 intake.

Hohne produced much more convincing evidence of the rising calibre of students than Sanders did. He also produced some significant results on failure rates in Physics and Chemistry which were key subjects in Science and Engineering courses. These departments were not only failing first-year students with good honours in their School Leaving examinations, but they continued to fail considerable proportions at second- and third-year level. As Hohne pointed out, no improvement in the selection process could influence rates of failure in these higher years. The remedy had to come from within the University itself. In 1944, 46 per cent of the Science and Engineering entrants had gained one or more first- or second-class honours in School Leaving,

but only 33 per cent graduated in minimum time. Almost half of these well-qualified entrants who passed first year subsequently failed in higher years. Hohne suggested that the possible reasons were inadequate first-year instruction, inefficient first-year examinations or extremely high level demands in later years. Whichever it was, he saw it as the responsibility of the University to improve its teaching and testing techniques (Hohne, 1955).

In 1958, Sanders produced another valuable report (Sanders, 1958*a*) in which he reviewed research and opinion on academic wastage and failure between 1928 and 1958. This included, in addition to the material already reported in 1948 and the findings of the Hohne reports, some discussion of failure rates in universities in other countries. The summary of results and conclusions (Sanders, 1958*a*, pp. 36–39), which were also contained in a summarized version of this report published elsewhere (Sanders, 1958*b*), gave a very clear picture of what was known about several aspects of student failure at this time. However, Sanders also admitted that research was still a long way from providing answers to some of the major problems of student failure.

An article published by Sanders in 1957 on the theory, history and psychology of university selection gave a very good summary of what was known up to that time and what questions still remained unanswered. Placing the selection problem in its historical context he perceived a shift in emphasis. Selection for admission to the community of scholars had given way to selection which would minimize student wastage in professional training. However, attempts to carry out the latter had been very disappointing and no selection procedure had yet been devised to account for all the human, environmental and academic variables in the total situation (Sanders, 1957).

In 1959, Sanders completed a report on the success and wastage arising from the Western Australian student intake of 1947. This study attempted to analyse some of these academic variables by investigating graduation and wastage rates in relation to both intelligence test (B40) scores and entrance examination performance. Comparisons were made between civilian and ex-service students, men and women students, older and younger students, faculty groups and sub-groups. It was an extremely thorough investigation and a modified version of the report was later published in book form (Sanders, 1961).

Sanders found that there were some significant correlation coefficients between first-year university results and both School Leaving marks and aptitude scores obtained from the tests. Language subjects at School

Leaving, verbal aptitude and mathematical aptitude all seemed to correlate with first-year university subjects, but Mathematics at School Leaving tended to correlate only with Mathematics and Physical Sciences at first-year level. However, none of these measures taken at the point of entrance to the University, nor any combination of them, provided a predictive value which would significantly improve the success rate of first-year students. Sanders concluded that the only real criterion for judging the potential for academic success of a student was whether that student could, in practice, do the required academic work.

Before Sanders had completed this lengthy study of the 1947 intake in Western Australia, a similar study had commenced in the University of Queensland under the direction of Professor F. J. Schonell. After a preliminary *post hoc* study of the full-time students who entered that University between 1950 and 1952 had been completed, it was decided that a longitudinal study should be undertaken commencing with the 400 students of the 1955 intake. This study extended over six years and the full report was published as a book in 1962 (Schonell, Roe and Meddleton, 1962), although some interim results were published by one member of the team in 1960 (Meddleton, 1960).

The analysis of the data gathered by this team covered many factors relevant to student performance such as prior scholastic attainment, home and parental background, place of residence, age, reading rate, study problems, personal problems, adjustment to university and university teaching. Of particular interest were the analyses of students' academic progress related to Matriculation results and IQ scores. It was clear that Matriculation scores showed a consistent pattern of high success rate for the group with high Matriculation scores and low success rate for the group with low Matriculation scores, but there was no clear cut-off point and even amongst those with the highest Matriculation scores some failed at university. The biserial correlation coefficient between Matriculation score and normal progress/failure to make normal progress was 0·48. When IQ score was used instead of Matriculation score the correlation coefficient was only 0·39 and combining the two scores produced a coefficient of 0·48. Thus, the IQ and Matriculation scores combined had no greater predictive value than Matriculation score alone. Those students who scored low on both formed a group with high failure risk, but a few individual students from this group did succeed and a few individual students who scored high on both did fail to make normal progress. Furthermore, although

the 400 students admitted to the University were a selected group compared to their age group, on both these criteria 60 of them, or almost 1 in 7, had left the University by 1960 without completing a degree.

This report was written at a time when Australian universities were facing the problems associated with rapid expansion. Enrolments at the University of Queensland had almost doubled from 1955 to 1960 and it was anticipated that they would double again by 1965. Although this meant that a steadily increasing proportion of the age group was entering the University, there was no evidence to suggest a lowering of the standards of admission. The authors rejected the idea of a limited pool of ability in the population. They suggested that it would be possible to follow a policy of accepting all matriculated applicants and still maintain standards within the University. However, standards would not be maintained unless the University overhauled its organization and improved its teaching.

The concluding chapter of this report contains recommendations for improvements in the quality of secondary schooling, university teaching and courses, examination procedures and staff–student relations within the University. These were seen as necessary steps for coping with the rapidly growing student population, because neither more restricted selection on the English pattern, nor the general lowering of standards required if the less restrictive American pattern were to be followed, appeared acceptable in Australia at that time. Even if a more rigorous selection had been desirable, this study had illustrated the complex nature of the problem of trying to improve prediction by improving selection techniques. Schonell and his colleagues suggested that although the search for better prediction would continue, the practical measures suggested above might be a more desirable and a more successful road towards reduced failure rates in the University.

The studies reviewed in this section all arose out of the wartime or post-war concern over student wastage, but before some of them were published the question of failure rates at university became even more prominent as a result of a Government Committee on Australian Universities. In December 1956, the Commonwealth Government set up a Committee of Inquiry into the future of Australian Universities under the chairmanship of Sir Keith Murray. The report described the high failure rate in Australian universities as a 'national extravagance which can ill be afforded' (Murray Report, 1957, p. 35). This gave new impetus to the search for better prediction and selection

in the context of the new deal for university education which followed on this report. This renewed attack on the problems of selection and prediction in Australia will be taken up in Chapter 4, while Chapter 3 will look at attempts to tackle similar problems in other countries.

CHAPTER THREE

SELECTION AT TERTIARY LEVEL IN OTHER COUNTRIES

United Kingdom

Although selection of students had been a problem for some British universities and Medical schools for many years, by 1945 the problem had become more general and had assumed new dimensions. Conferences of the Home Universities in 1947, 1951 and 1952 all devoted considerable discussion to the problem (Association of Commonwealth Universities, 1947, 1951, 1952). Just before the 1951 Conference, the *Universities Quarterly* published four short papers which raised some of the issues and problems associated with selection. In one of these papers, Nicholson pointed out that there were two different approaches, namely, choosing the best of the applicants to fill a limited number of places or fixing a minimum standard for entry and accepting all who attained that standard. He favoured the latter alternative and suggested that if numbers rose then universities would need to argue the case for growth and development (Nicholson, 1951). It is interesting to note that Cunningham made a similar comment in his preface to the first Hohne report published in Melbourne in the same year.

In another of these four papers Dale drew attention to the fact that the proposed grants to university students meant that selecting for admission was equivalent to awarding a scholarship and should be treated with the same degree of care. Since the number involved was increasing, some systematic form of selection should be sought. He quoted Victoria and New Zealand as examples of accrediting, but did not seriously suggest this for Britain. His conclusion was a plea for using actual marks obtained in General Certificate examinations as the main selection criterion (Dale, 1951*a*).

A study of this type of prediction, based on the earlier Higher School Certificate examinations, had just been published by Williams. This was carried out at Sheffield University between 1943 and 1947 and involved 495 students enrolled in the faculties of Arts, Science and Medicine. Correlations were calculated between Higher School Certificate scores and first-year university results for separate subjects. Although the

correlation was generally higher for Science subjects than Arts subjects, 30 of the 68 coefficients were less than three times their probable error. Some possible general explanations for these low correlations were lack of reliability in examinations, variations in teachers and teaching and problems of transition from school to university. Factors related to specific subjects were also discussed in the hope that knowledge of these might help to make the new General Certificate Examinations better predictors (Williams, 1950).

In 1951 and 1952, Dale published three further papers on particular aspects of selection, the interview, the use of psychological tests and the prognostic value of the university entrance examination (Dale, 1951*b*, 1951*c*, 1952). The contents of these three papers are included in his book *From School to University*, which provides a comprehensive discussion based on some recent studies such as those of Sanders and Hohne in Australia (see Chapter 2) and that of Williams mentioned above. In an attempt to explain the failure at university of selected applicants, Dale carried out an investigation of the 53 scholarship holders for each of the years 1946 and 1947 at the University College of Swansea. These students were given verbal and non-verbal intelligence tests and a questionnaire to complete. A case-study approach was then adopted for those students who failed any first-year examination. Although he concluded that the principal cause of failure was not lack of ability but lack of effort, Dale found that the reasons for this lack of effort were many and varied. Educational guidance at both school and university was seen as necessary to overcome some of the problems which students faced. In particular, guiding students into the courses and institutions most suitable for them was suggested as one way to reduce disillusionment and loss of interest by students. However, the selection problem would still remain and Dale saw the academic examination as the principal criterion to be used in conjunction with intelligence tests and school records. The most dangerous of all the aids to selection, in his opinion, was the interview.

Dale had suggested that selection for university began as early as the Secondary Grammar School Entrance Examination, but the Nuffield study, which was going on at the same time, went even further than this. Furneaux's first conclusion in the report of this Nuffield study (Furneaux, 1961) was that selection really began when children were born, as social class strongly influenced a child's academic history. This did not imply any bias on the part of the selectors, but merely reflected the lower success rate at elementary and secondary school level of

children from the lower socio-economic classes. Those pupils who overcame the disadvantages associated with such a background sufficiently to survive to the end of secondary school were generally found to be uncharacteristic of their group. It was suggested that a modification of the system to permit more children to attempt the course leading to the General Certificate Examination could have approximately doubled the number of students entering the universities. Even if this were not done, the birth-rate figures were already indicating that a rapid increase in applications for university places was likely from about 1960 onwards. Hence selection was expected to remain a problem for many years to come.

This Nuffield study was particularly concerned with the problem of selection and in 1948 it undertook a ten-year investigation which included eight years of testing and collecting data from students at both secondary and tertiary levels. Each university carried out its own selection and pupils submitted multiple applications, but there was no way of comparing the criteria used or the decisions reached by different institutions. In discussing the validity of selection techniques Furneaux pointed out that although school-leaving examination results appeared to give the best indication of academic quality, these were often not the main criterion used for selection. Tentative selections were usually made before the A-level results of the GCE were known. Headmasters' reports were seen as a potentially valuable source of information, but the method of communication was ineffective. Furneaux agreed with Dale about the use of interviews and suggested that there appeared to be no evidence that they contributed to the validity of selection.

By 1958, Dale had become concerned about the difficulty of improving selection and prediction while university examinations were lacking reliability. He saw the ignorance of university staff members about examining techniques as one of the major problems to be tackled. In his article on university standards (Dale, 1958), he urged members of staff to take heed of the dangers inherent in their examinations. He suggested that new appointees should be required to attend a summer vacation course covering not only the techniques of lecturing, but also an understanding of examinations and their uses.

When Mountford discussed the results of a survey covering 2214 students who had entered the University of Liverpool between 1947 and 1949, his conclusions were in complete agreement with Dale's (Mountford, 1957). The survey results had been published the year before and

revealed that 71 per cent had graduated in minimum time and a further 13 per cent had completed their qualification with one or two years delay. Of the 280 students who abandoned their courses, 31 did so for non-academic reasons (Mountford, 1956). In his later discussion of these drop-outs and failures, he made some positive suggestions for reducing the problem. The students needed greater guidance and the universities needed to take their responsibilities of teaching and examining more seriously.

A similar study which overlapped in time with this Liverpool one was that reported by Malleson at University College, London. For the years 1948–51 the average intake was 635 students and approximately 27 per cent of these failed to graduate in the normal period (Malleson, 1958). These figures are similar to the Liverpool ones where those not successful in the normal period constituted 29 per cent of the average intake of 738 students. It is more difficult to compare these figures with those obtained from Keele University in their first nine years. There the total intake was only 1250, giving an average intake of about 140, and the failure rate of 15 per cent represented those who had commenced between 1950 and 1954 and had failed to complete the four-year course by the end of 1958. This 15 per cent did not include all those who took longer than the normal period to complete the course.

Although all these surveys were building up research data about student performance, failure and wastage, it was not until the University Grants Committee conducted a series of surveys of the 1952, 1955 and 1957 undergraduate intakes at twenty-four universities that an overall picture emerged. It was the results of these UGC surveys, together with those of the studies mentioned above, which provided the statistics on undergraduate wastage for the Committee on Higher Education set up in 1961 under the Chairmanship of Lord Robbins (Robbins Report, 1963). Defining wastage as the percentage of undergraduate entrants who left the university without success, the UGC surveys gave figures of 16·7, 13·9 and 14·3 for the years 1952, 1955 and 1957 respectively. These were all between the 13·1 average over the years 1947–49 in Liverpool and the 18·1 average for 1948–51 in University College, London. The apparent consistency of these results was misleading, for the UGC figures for different faculties and different universities reveal wide variation. The most recent figures available to the Robbins Committee showed the wastage rate for individual faculties ranging from 9 per cent in Dentistry to 21 per cent in Technology, while comparison between universities for entrants in Arts, Science and Technology

in 1957 revealed a variation from 4 per cent to 34 per cent (Robbins Report, 1963, Appendix Two (A), Part IV).

The Robbins Report produced a wealth of statistics and, in a situation where it predicted that in the next twenty years there would be a 30 per cent increase in the age group and a doubling of the proportion of these completing secondary education, it was not surprising that it stimulated many more investigations into wastage, selection and prediction. The Robbins Committee completely rejected the concept of a limited pool of ability and concluded that 'scarcities of inherited potential will not, as such, impose a limit on the growth in the output of qualified school leavers within the next twenty years' (Robbins Report, 1963, Appendix One, p. 89). It was understandable that the nature of the selection problem would change between 1961 and 1980 if, as was predicted, the proportion of the age group being selected for university went from 4·4 per cent to 10·0 per cent and the proportion entering all forms of full-time higher education increased from 8·3 per cent to 16·7 per cent. After only five years it was clear that these figures were underestimates of the rate of growth. Layard discusses the actual effect of this expansion on selection from 1961 to 1967 (Layard, King and Moser, 1969). Although the proportion entering universities had risen to 6·3 per cent by 1967 and the figure for all higher education was then 14·3 per cent, the proportions completing secondary school and qualifying for entry to tertiary institutions had also increased beyond the level predicted in the Robbins Report. The nett result was an overall improvement in the availability of tertiary places, but university places had declined as a proportion of all tertiary places. The selection rate for the universities remained almost constant from 1963 to 1966 at approximately 62 per cent of the qualified applicants (Layard, King and Moser, 1969).

In the next six years following the Report on Higher Education, the University of Birmingham conducted a survey of undergraduate wastage which showed a consistent rate of about 6 per cent for each of the years 1964 to 1969 (Cox, undated). However, it is difficult to interpret this result as wastage is defined as failure in a single year. It is not clear whether this figure includes all students at all levels in that calendar year or just the intake group for that year. If it is the latter, the wastage within one intake over the whole course could be as high as 12 per cent since the UGC surveys indicated that only 50 per cent of wastage occurred at first-year level, a further 25 per cent of it occurring in each of second and third years (Robbins Report, 1963, Appendix Two (A),

p. 130). One interesting trend which did emerge from the Birmingham survey was in the proportion of academic and non-academic reasons for the wastage. In 1964, approximately one-quarter of the wastage was due to non-academic reasons, but by 1969 this proportion had risen to a half (Cox, undated, p. 15).

Feagins, in an article discussing the section of the Robbins Report on wastage, pointed out that variation between universities was a reflection of the different treatments meted out to failing students. Some universities provided ample opportunity for the student to resit the examination, repeat the course or transfer to another course, while other universities simply expelled him. It was this discarding of the failed student which was seen as the unnecessary wastage and it was suggested that universities could reduce this by improving their salvage machinery (Feagins, 1968).

A later survey (Great Britain, University Grants Committee, 1968) did show a slight reduction in failure to graduate due to academic reasons, but the overall percentages for success remained much the same as in the previous surveys. The proportion completing degrees in normal time was 77·7 per cent and the proportion completing in one year above normal time was 7·8 per cent. This survey was carried out for all universities in Great Britain and it analyses the success and failure of those students who should have graduated in 1966 had they completed their courses in normal time. This meant that those students were admitted between 1960 and 1963 depending upon the length of course taken. The report gives extensive tables of success and failure for each faculty in each university and identifies the cause of failure as academic, illness, disciplinary action or other reasons (Great Britain, University Grants Committee, 1968).

Although wastage rates in Britain were not high by world standards, much time was devoted to studying the problem, suggestions for reducing wastage falling into two categories. There were those who saw the possibility of the remedy coming from within the university with improved teaching, examining and counselling of students. Others concentrated their efforts on searching for better selection techniques based on better predictors. One of the studies of this latter type, which is often quoted, dates back to the immediate post-war period. This investigation into the usefulness of psychological tests as a means of selection was carried out at the London School of Economics between 1946 and 1950 and reported in three articles published during 1950 and 1951 (Himmelweit and Summerfield, 1950–51). The first of these articles

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gave a review of the literature on studies of both cognitive and non-cognitive factors in student selection, while the second and third articles reported the experimental investigation. In the discussion of the significance of the results, the claim was made that the five hours of testing using a battery of eighteen tests of cognitive ability, cognitive achievement, motivation and personality characteristics would have resulted in reducing the failure rate from 15 per cent to 3 per cent. This prediction was based on multiple correlation coefficients between predictor variables obtained from the battery of tests, and class of degree awarded, the values of these coefficients being 0·56, 0·64 and 0·55. The claim for such an improvement in pass rates on the basis of these correlation coefficients was understandable when it was revealed that the actual criteria for selection, namely the three sections of the entrance examination, when correlated with Degree Class, produced a multiple correlation coefficient which was not significantly different from zero. It was admitted that the entrance examination did not rank the accepted candidates 'along any scale that would enable one to predict whether they would do well or badly in their Final examination' (Himmelweit and Summerfield, 1951, p. 71). It is not surprising that so much of the research work on student wastage was being focussed on the search for better predictors.

In spite of all that was done and written about selection in the next decade, Himmelweit found the situation much the same when a second study was carried out at London School of Economics. The students who took part were those entering in 1957–59. These had been selected on the basis of O-level results and headmasters' reports. Neither of these was found to have good enough predictive value to be adequate for selection. A-level results showed some slight correlation with degree results for B.Sc.Econ. students (+0·14), but for Law students the association was insignificant. Furthermore, the correlation seemed independent of the relevance of A-level subjects taken to the subjects within the degree. When the best combinations of scores from the psychological tests were correlated with degree results, this produced multiple correlations of 0·51 for Law and 0·48 for Sociology. On the basis of these two similar sets of results from studies carried out in the same institution, but separated by more than ten years, Himmelweit recommended a centrally administered Scholastic Aptitude Test for all applicants to all colleges and universities. The American Aptitude Test was not seen as suitable and it was considered that a test should be specially designed for this purpose (Himmelweit, 1963).

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A similar plea for the use of a Scholastic Aptitude Test had been published by the Professor of Education at Manchester University. He had based his case not on experimental evidence but on considerations of the pressures of time and numbers in an expanding system. He criticized the great reliance placed by universities on GCE results which he considered to be lacking reliability. A properly designed and administered Scholastic Aptitude Test could provide a more reliable measure for comparison of applicants (Oliver, 1961).

An experimental study using an American Scholastic Aptitude Test was carried out in four selective girls schools and four selective boys schools in 1965 and the scores were found to be valid predictors of grades on essay examinations and rank-in-class. These conclusions resulted from correlations with O-level and A-level results, but these correlations indicated nothing about possible predictive value for university success (Fremer, Coffman and Taylor, 1968).

The Robbins Report had also recommended that the use of scholastic aptitude tests be investigated. It was suggested that these tests would provide additional information about students and more efficient selection might result from using more than one type of test. In 1966 the Committee of Vice-Chancellors and Principals of the Universities of the United Kingdom organized a research project to try out a Test of Academic Aptitude (TAA) which was derived from a test constructed by Professor Oliver of Manchester University. The TAA provided two sub-scores, a mathematical score and a verbal score. In 1967, 27 000 sixth-form students took this test and the National Foundation for Educational Research undertook the analysis of the data collected. Details of the test and the sample of pupils are contained in the first report which dealt with the transition from school to higher education or into employment (NFER School to University Research Unit, 1972).

A second report (NFER School to University Research Unit, 1973) analysed the prediction of academic success based on the TAA and the GCE examinations. Of those students tested in 1967, 7000 entered universities in 1968 and their first-year results and degree results were subsequently collected. Correlations between these results and TAA and GCE results showed that for most courses the best predictors of both first-year performance and degree results were GCE A-level grades. However, the correlation coefficients were generally low, ranging between 0·2 and 0·4 for A-level grades with degree results and between 0·2 and 0·5 for A-level grades with first-year results. The report concludes: 'It would be difficult to justify the use of such a weak

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predictor if better measures were available' (NFER School to University Research Unit, 1973, p. 63). Unfortunately this study was unable to suggest any better measures. Neither the TAA sub-scores taken separately nor combinations of them produced correlations with first-year results of more than 0·2 for the whole sample. School assessments gave higher correlations than TAA scores, but lower correlations than A-level grades. None of these measures provided an efficient means of identifying those who would subsequently fail their university courses and there was no evidence that a useful system of threshold criteria could be based on A-level grades.

A specially designed Reasoning Test for higher levels of intelligence was developed by Valentine and tested on groups of graduates and undergraduates. When the mean scores for graduates with first-class honours, second-class honours, third-class honours or pass degrees were calculated, the differences between means were significant for first- and second-class honours, second- and third-class honours and second-class honours and pass degrees (Valentine, 1961). These results from *post hoc* testing of graduates did not necessarily imply a high predictive value for the test and only one example of the use of the test on university applicants is given in this article. For a highly selected group of 47 honours graduates in Psychology at University College, London, the correlation of test scores and final honours examination marks was 0·396. The corresponding correlation for scores on the AH5, another high level intelligence test, was 0·320 and for GCE results 0·302. The data supplied in this paper are insufficient to judge the possible value of this test as a selection device.

Another attempt to compare these same three tests as predictors was carried out at Sheffield University between 1955 and 1963. A total of 252 first-year Psychology students were given the AH5 and the Valentine Reasoning Test. Correlation with final Degree Class was calculated for scores from both these tests, mean A-level mark and mean first-year university mark. The AH5 gave the lowest coefficient (0·181) and Valentine score (0·276) and A-level mark (0·300) were about the same, with first-year university mark (0·524) significantly better than all the others (Pilkington and Harrison, 1967).

Several studies which focussed attention on A-level scores as predictors investigated the value of individual subject scores for this purpose. Richards and Wilson found that for students scoring better than 60 per cent in A-level Physics the rate of graduation in minimum time was about 80 per cent, whereas for those scoring less than 55 per

cent in Physics the graduation rate was only about 40 per cent (Richards and Wilson, 1961). A more recent study by Elton of 397 honours Physics students selected from a number of different universities and colleges showed that total A-level score was a better predictor of final Degree Class in Physics (correlation 0·35) than either Physics (0·26) or Mathematics (0·28) A-level scores alone. First-year university scores in both Physics (0·67) and Mathematics (0·62) gave the highest correlations with Degree Class and the lowest correlations were those obtained from the two scores on the Advanced Placement Examination in Physics of the College Entrance Examination Board in the USA (Elton, 1969).

When Bagg analysed the records of 621 students who graduated in Chemical Engineering between 1957 and 1969 he found that the influence of A-level scores in Chemistry, Physics and Mathematics on the first mid-year examinations was appreciable, but this influence diminished with progress through the three years of the university course (Bagg, 1970). This result agreed with that of Austwick's earlier study of 223 students entering the Faculty of Arts at the University of Sheffield in the years 1954, 1955 and 1956. Although significant correlations between A-level and first-year university results were obtained for French (0·6), Modern History (0·3), Geography (0·3) and Latin (0·5), correlations between A-level and final degree result all dropped below the 0·05 level of significance, except for French where the value was again 0·6 (Austwick, 1960).

In 1971, Heywood published a very good review article on student wastage in which he brought together the results of many studies. In the section on prediction and selection, he summarizes the findings of several of the studies discussed above. This article discussed many other aspects of the topic including studies on student withdrawals, the causes, both cognitive and non-cognitive, and some methodological problems associated with studying student wastage. In addition, it included an extensive bibliography (Heywood, 1971).

Although A-levels showed up most often as the best of the predictors, most of the research workers have shown that even A-levels have little predictive value in terms of graduation results. One of the few articles to express satisfaction with academic examination results as the criterion for selection was that of Lee on the Oxford and Cambridge students between 1966 and 1971. He concluded that there was good correspondence between the pattern of GCE scores and the pattern of university examination results, and hence the selection process could be

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regarded as effective over a fair range of candidates (Lee, 1972). It might well be asked what is the criterion for an effective selection process in the highly competitive situation at Oxford and Cambridge. It is possible that many who fail to gain entrance to these two universities would also have succeeded and produced similar patterns of correspondence.

Several valuable articles on aspects of the selection problem appeared in a Sociological Review Monograph in 1963. One of these articles has already been mentioned (Himmelweit, 1963). Two others, one by Vernon and one by Kelsall, are of particular relevance. Kelsall's paper is a review of the British evidence on selection in relation to subsequent academic performance, most of which has already been mentioned here (Kelsall, 1963). Vernon's article 'The Pool of Ability' was virtually his submission to the Robbins Committee in which he completely rejected the idea of a limited pool of students capable of succeeding at university. He also rejected the suggestion that admitting more students would necessarily bring about dilution of standards in the universities. While conceding that some form of selection would continue, Vernon did not hold out much hope for rapid or marked improvements in the selection process. He suggested that it would be more profitable to think of the problem in terms of progressive guidance towards a suitable career for each student (Vernon, 1963).

Although the examination system is quite different in Scotland from that in England, there appears to have been little early research done specifically on the predictive value of the Scottish School Leaving Certificate. One study done at the University of Edinburgh in 1958 concluded that the SSLC had good predictive value because there was a significant difference in overall academic performance between two groups differentiated by their results at SSLC. One such comparison was between the top 10 per cent on SSLC scores and the remaining 90 per cent. Another comparison was between the bottom 17 per cent and the remaining 83 per cent (Gould and M'Comisky, 1958). Such an analysis is very difficult to interpret as a measure of predictive value.

In 1961, a long term project on Assessment for Higher Education was initiated in Scotland. Data were collected from 1962 to 1970 and the Scottish Council for Research in Education published the report of this project in 1973 (Powell, 1973). Students entering universities in 1962, 1963 and 1964 sat for the College Entrance Examination Board Scholastic Aptitude Test as well as the Scottish Certificate of Education. The SAT gave both Verbal and Mathematical scores, but both of these proved to be of little use in predicting attainment of a degree. Further-

more, they provided no evidence that ability was operating as a threshold variable. Teacher assessments, scaled on the scores in the SCE examination, were no better as a predictor than the SCE itself. This latter was the best pre-entrance predictor, although the maximum correlation with graduation success was 0·5. First-year results at university were a better predictor of success in gaining a degree but, by the end of first year, more than half the wastage had already occurred. Hence there was a need to find a better predictor to operate at the point of entry.

In his concluding paragraph to this report, Powell sounded a word of warning to those who were hoping to solve the problem of wastage by shifting the emphasis away from selection and towards the use of testing for student guidance. He pointed out that if guidance was to be based on information gained from tests, then the need for better prediction would become more acute. 'Levels of prediction that yield guidance slightly better than chance are useless to the recipients of the advice' (Powell, 1973, p. 80). On the other hand, he saw the possibility of some non-cognitive tests, which were unacceptable to the community as selection devices, being accepted for guidance purposes. This study, like so many before it, exposed the complexities of the problem, but still left it unsolved.

New Zealand

The early history of examinations for university entrance in New Zealand was reviewed by Thomas in *Entrance to the University* (Thomas, Beeby and Oram, 1939). It appeared from this review that opposition to an external examination, controlled by the University and imposed upon the secondary schools, was expressed in articles and reports of committees as far back as 1914. Suggestions for some sort of accrediting also seemed to appear from about the same date, but it was 1944 before such a change took place. Thomas deals in some detail with the arguments for and against accrediting and the change in attitudes which took place in both the University and the secondary schools. This section makes very interesting and relevant reading for those interested in the problem of testing for selection at the present time.

Beeby and Oram undertook an analysis of past records to try and determine how well the University Entrance Examination had operated as a selector and predictor. They took as their base years 1926 and 1927, taking those students who passed the Entrance Examination in those

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years. These were ranked on average marks in best five subjects and divided into quartiles. When they looked at the success at university of those who enrolled they concluded that there was a general correspondence with average mark on Entrance Examination, but this was not great enough for the latter to be used as a predictor of individual success or failure. The degree of correspondence was much better in the top quartile than in the second one and still clearly better in the second than in the third, but was not very different for third and fourth quartiles. Failure rate at university could only have been markedly reduced by rejecting all those in the bottom half. If the bottom quartile only had been rejected in both years, this would have kept out 65 of the 600 who graduated. Correlations for individual subjects at Entrance Examination and first-year university were mostly significant but low, the highest being 0·56, and total University Entrance mark gave at least as good a prediction of success in individual subjects in first-year university. First-year results were found to be a better predictor of graduation success than Entrance Examination, but this was still not good enough for prediction about individuals.

These results all show a high degree of agreement with many more recent studies, but there were four results of particular interest in the light of recent developments. One was the indication that the fewer attempts required to pass the Entrance Examination, the better the chances of success at the University. The second was that the chance of completing a degree seemed to be improved by a break of one or two years between school and university. Thirdly, a fairly high degree of correspondence was found between school estimates of performance and actual performance in the Entrance Examination, and fourthly the Otis Intelligence Test produced a spread of scores with no clear cut-off points and no real basis for rigid selection.

This early study was undertaken as a result of decisions by the New Zealand Council for Educational Research and the University of New Zealand in 1934 and 1935. It was just twenty years later when, in 1954, the University asked the Council for Educational Research to examine the effects of the standard of the University's entrance qualification upon the performance of students taking Stage I subjects. It was anticipated that the number of applicants for university entrance would increase rapidly in the 1960s. Hence the University had to decide whether it should extend its facilities or restrict the increase of entrants by some means which would not decrease proportionately the output of graduates. Because of the urgency of this situation it was decided to

study all first-year students in the four universities in 1955. The correlations between School Leaving and first-year university results were found to be of the same order of magnitude as those found in the earlier New Zealand study and in studies carried out elsewhere. Some relationship could be demonstrated, but it was insufficient for purposes of individual predictions. In interpreting the results, Parkyn discussed the problems of the validity and reliability of both School Leaving and university scores, particularly with the system of accrediting which was then operating at School Leaving level. There was also a detailed discussion of the statistical limitations in the problem and the effect on correlation coefficients of rejecting part of the population after the first measure had been used to select those who will constitute the population for the second measure.

Taking a set of figures which were typical of the results obtained in this study, Parkyn showed that with a correlation of 0·54 and a failure rate of 33 per cent, it would have been necessary to exclude over half the entrants in order to reduce the Stage I failure rate to 16 per cent. Furthermore, of those students who would have been excluded, approximately half actually passed. Parkyn concluded that there appeared to be no justification for raising entrance standards or for abandoning the principle of accrediting. In the second volume of the report, he examined the day-to-day life and work of the students within the University, for it seemed that this was where the most important causes of failure were to be found and the most effective action could be taken to reduce student wastage (Parkyn, 1959).

A study to supplement Parkyn's investigation was undertaken by Small at the University of Canterbury. Using three indices, namely an intelligence test (B40), a reading score and School Certificate total mark, to rate students on an academic aptitude scale, he produced predictions of success or failure in first year. These predictions were accurate in less than half the cases and attempts to improve them by the addition of further information about personal characteristics were not successful. Small concluded that student performance was so idiosyncratic that it would be difficult to reduce the failure rate by any of these measures. He suggested that there was a need for universities to do more to meet the individual needs of students through better guidance procedures at the point of transition from school to university and improved university teaching (Small, 1963). A more detailed account of this research is given by Small in his book published three years later (Small, 1966).

The criterion for success in all these New Zealand studies had been pass or fail in university examinations, yet Mitchell showed in his examination of failure rates in four of the major subjects in each of two faculties that considerable fluctuations occurred over a period of seven years. Not only did failure rates vary widely from subject to subject within the same year, but also from year to year for the same subject. In one second-year subject, the failure rate went from 57 per cent in one year to zero in the following year. No clear reasons could be found for these variations. Although the mean overall failure rate was significantly lower in second year (21·7 per cent) than first year (27·3 per cent), these were of the same order of magnitude. When the same group of students was followed through from first year to second year, there did not appear to be any consistent relation between the failure rates, but there was some degree of relation between first- and second-year results in the same calendar year. It appeared that similar standards were being applied to both levels in any one year, but these standards changed from year to year. Mitchell concluded that such patterns of failure could not be explained in terms of poor preparation of students at school, but were more likely to be due to factors operating at university level (Mitchell, 1962).

The system of examinations at senior secondary school level in New Zealand is an unusual one. The School Certificate at the end of fifth form is an external examination but the University Entrance Examination in sixth form is at least partially internally assessed within a system of moderating. Although this arrangement has survived almost unchanged for a quarter of a century, it is clear that the role of national examinations is once more being questioned. A recent publication by the New Zealand Council for Educational Research (Elley and Livingstone, 1972) set out clearly the historical background and development of the present debate. It also gave a full account of the methods of moderation and some alternative plans for reform of the examination system. However, it is clear that the debate is no longer dominated by considerations of predictive validity for success at universities. The examinations are being challenged and defended in terms of much wider implications for education in general and the backwash effects on schools, teachers and pupils.

United States of America

Testing for selection at tertiary level in the USA has been organized centrally since the College Entrance Examination Board was established

in 1900. In the early years the examination consisted of achievement tests in a set list of subjects based on set courses of study. In 1926 a Scholastic Aptitude Test was included and in 1929 the student's report contained two separate scores for this, a verbal aptitude score and a mathematical aptitude score. Wholly objective achievement tests were first introduced in 1937, principally for scholarship applicants, and these came into general use in 1942. The Scholastic Aptitude Test was retained, not because it was by itself a good predictor of college performance, but because it improved the prediction when it was combined with Achievement Test Scores and school records. It also had a value as a device for standardizing school reports from different types of schools. Angoff has edited a comprehensive account of the work of the CEEB including the historical development of this testing program, the technical details of the tests, their construction, interpretation and use and a summary of recent American research into the problems of selecting college students (Angoff, 1971).

In 1967 a Commission on Tests was set up to undertake a thorough and critical review of the College Board's testing functions in American education. After considering possibilities for fundamental changes in the tests and their uses in a situation of mass post-secondary education, the Commission recommended that the College Board should continue, but with some modifications to their current tests. The Commission saw the Board as serving three functions in American education:

1. A 'distributive' function by contributing to comprehensive and sensitive descriptions of students, of colleges and their programs, and of the potential relationships between the two as both students and colleges engage in a process of reciprocal choice.
1. A 'credentialing' function by certifying demonstrable educational attainment whether acquired by attendance in school or college or not.
3. An 'educative' function by instructing students both in subject-matter areas and in the skills and methods of making decisions and choosing.

(College Entrance Examination Board, 1970, p. 109)

During the 1950s and 1960s many colleges were concerned about the problem of student withdrawals, drop-outs and student mortality. These were the subject of many investigations which tried to analyse the differences between the drop-outs and the continuing students, often not with the aim of improving selection, but in an attempt to find ways of improving the college experience in order to improve the retention

rate. These studies looked at cognitive and non-cognitive factors but their results were often conflicting. Bragg found that the only factors which discriminated significantly between drop-outs and continuing students were High School Average and Academic Average in first semester at college. Performance on other sub-sections of the entrance test discriminated, at best, for top-level students only and non-cognitive factors such as age and sex did not discriminate significantly at any level (Bragg, 1956).

Gekolski and Schwartz investigated factors such as age, sex, school attended and marital status as well as scores on the Scholastic Aptitude Test, a reading test and a personality test for 816 freshmen entering a Liberal Arts College, a Teachers College and a School of Business and Public Administration. Students who had withdrawn by the end of first semester were compared with the rest and significant differences between these two groups were found only in the Scholastic Aptitude Test, the reading test and the social adjustment section of the personality test. The drop-outs were interviewed and their reasons for withdrawing including change of interest, dissatisfaction with the course or the institution and problems of adjustment, finance and health. Only 9 per cent gave as their reason low academic grades. The continuing students were found to have all these same problems, but to a lesser degree. Twenty-seven per cent of the drop-outs expressed a need for more guidance and 11 per cent wanted better courses and methods of instruction. The authors recommended that the institutions should re-examine their curricula, make their instruction more effective and improve counselling services for students (Gekolski and Schwartz, 1961).

Most studies which have compared students in different faculties have shown the same measure to have different predictive value for the different faculties. One possible explanation for some of this variation was suggested by Pohl and Pervin in their study of cognitive style measured by the Schroder Paragraph Completion Test (PCT). This test was given to 150 Princeton upper class men volunteers from the faculties of Engineering, Natural Science, Social Science and Humanities. These students showed no significant difference between the four faculties on their Scholastic Aptitude Test Verbal scores but the SAT Mathematical scores were significantly higher for those in Engineering and Natural Science than for those in Humanities. On the PCT the Humanities students were significantly more conceptually abstract than the Engineering students who were the more cognitively concrete group. In Engineering the cognitively concrete students did

better academically than the conceptually abstract ones, but in Social Science and Humanities the reverse was true. For Natural Science students no significant difference in academic performance was found between the two types of cognitive style. Different academic disciplines were seen as presenting different task requirements and academic performance was seen as a function of the interaction between the cognitive style of the student and the task requirements of the course (Pohl and Pervin, 1968).

Another possible reason for pre-college aptitude and achievement tests being poor predictors of final year college grades was suggested by Lunneborg and Lunneborg at the University of Washington. They hypothesized that there were uneven changes in aptitude maturation during the years at college. The subjects for this investigation were 126 senior college students who volunteered to re-sit the pre-college battery of tests they had taken four years earlier. These students had all made normal progress in their courses over the four years and were significantly superior to the whole freshman class in which they began. Correlations were calculated between their pre-college scores and their quarterly grades over the four years. For the first three years correlations were mainly significant and showed only slight decreases with time, but in the fourth year they dropped to near zero. However, the scores obtained at the re-sit of the pre-college tests correlated no better with the quarterly grades in the fourth year. Comparisons of the scores from the two sittings of the aptitude and achievement tests showed that significant intellectual growth had taken place over the four years but this growth was relatively uniform for the different aptitudes of an individual student. The findings did not support the hypothesis and the writers suggested that unreliability of senior grades based on disparate course selection could be one source of fourth-year unpredictability (Lunneborg and Lunneborg, 1970).

A comprehensive review of American research prior to 1960 is given in an article by Fishman and Pasanella. This contains an extensive reference list covering hundreds of studies which showed that both high school achievement and aptitude scores correlated about 0·50 with first-year college grades. By combining the two scores multiple correlations of around 0·60 could be obtained, but for the more highly selected groups of students the correlations were much lower. Although there had been many studies done on non-cognitive factors, these had contributed little to the solution of the practical problems of selection and prediction (Fishman and Pasanella, 1960).

The research studies included in this section are a very small sample indeed of the large number of such studies which have been carried out in the USA. They have been selected because they are articles which are readily available in Australia and they present different approaches to some aspects of the selection and wastage problem which are relevant to the situation in Victoria. However a comprehensive overview of the research situation has been published by Lavin. This book is valuable, not only for its account of research, but also for its theoretical discussion of the problem. It deals with the difficulties of defining, measuring and predicting academic performance and discusses cognitive and non-cognitive factors in prediction as well as sociological determinants of academic performance. Although ability measures had consistently shown up as the best single predictors, they could account for less than half of the variation in academic performance. In the search for non-cognitive factors as explanatory variables, research had proved very disappointing, but Lavin suggested that this might be due to the student being seen as existing in a social vacuum. He suggested that the characteristics of the social setting in which the predicted academic performance would take place should be analysed. Perhaps the interaction between student and social setting was the important thing to be investigated. Lavin saw a need for a greatly broadened context and the establishment of dimensions of performance related to life after graduation as prerequisites to better predictive models (Lavin, 1965).

CHAPTER FOUR

MORE RECENT DEVELOPMENTS IN AUSTRALIA: A LONGER TERM VIEW OF THE PROBLEM

By the end of 1956, when the brief was written for the Committee on Australian Universities, the problems of increasing numbers of university students were no longer being discussed in terms of the post-war crisis. This Committee was asked tc 'indicate ways in which the universities might be organised, so as to ensure that their long-term pattern of development is in the best interests of the nation' (Murray Report, 1957, Appendix A). In its report the Committee was quite outspoken about student failure rates. It quoted figures from a Commonwealth Office of Education survey of the entrants in 1951 to the six universities which showed that 61 per cent of these passed first year in 1951, 35 per cent graduated in minimum time and total expected graduation rate was only 58 per cent. Failure rates of this level were considered to be a national extravagance which Australia could ill afford. It was suggested that universities should aim at halving this failure rate and set as their goal a graduation rate of 80 per cent.

At this time, entrance to universities in Australia was, in general, non-selective and the Committee recommended that this should continue. In view of the demand for graduates, a selective method of admission was not seen as a solution to the rapidly increasing demand for university education. It was considered preferable to admit all qualified applicants and provide them with the teaching and facilities necessary to maximize their chances of graduating. In particular, the report pointed out the responsibility of the universities to provide adequate teaching for first-year students by appointing to their staffs people who were skilled teachers as well as highly qualified academics and researchers.

Although it has been shown in Chapter 2 that research workers were already investigating many aspects of wastage and prediction, the Murray Committee's statement on failure rates stimulated both more research and a wider interest in the issues. Lack of definition of terms like 'failure rate' meant that the figures were not always calculated in the

same way. This made it difficult for the reader to compare studies and draw conclusions. For these reasons Hughes pleaded for an agreed definition of subject pass rate and showed how an estimate of minimum time graduation rate could be calculated, given the subject pass rates in each year (Hughes, 1960*a*).

Although earlier studies of these individual subject pass rates had shown considerable variation from subject to subject (Hohne, 1955; Sanders, 1958*a*), A. W. Anderson showed that there was remarkable consistency in the first-year examination grades for individual first-year students at the University of Western Australia in 1957 and 1958. When results were graded in five categories, about two-thirds of students gained results which varied no more than two grades in the spread of grades over their four subjects. Furthermore, the better the performance, the more consistent were the grades obtained (Anderson, A. W., 1959).

In another study of Science students entering the University of Western Australia in 1957 and 1959, Anderson selected 132 students (approximately 60 per cent of the two intakes) who had studied English, Physics, Chemistry, Mathematics A and Mathematics B at Matriculation level. He compared their average marks for these five subjects and their scores on the B40 intelligence test with the number of subjects they passed in first year and concluded that, if selection of entrants became necessary, Matriculation score would be the best basis, IQ score being of little value for predicting success. However, a combination of Matriculation and IQ scores identified those with high IQ and low Matriculation scores as the group most at risk (Anderson, A. W., 1960). These findings are very similar to those obtained by Hogben working with all Science students entering this same university in 1957 (Hogben, 1961). The identification of the group most at risk was followed up by others during the next decade and, in 1970, Pentony and Loftus published a summary of results of several studies on the performance of Science students in relation to Matriculation and IQ scores. With the exception of one study at Newcastle University, all the results supported those of Anderson and Hogben. The high IQ, low Matriculation group were seen as having a low level of application and motivation. It appeared that, in many instances, nothing happened at university to change these students. Hence, they were likely to fail (Pentony and Loftus, 1970).

Hogben's 1961 article also reported some findings on school prior to entry and academic performance at the University of Western

Australia. Students from State and Roman Catholic schools had better entrance qualifications than students from the Independent schools, but first-year results were comparable for all three groups. However, the State schools produced proportionally three times the number of minimum time graduates produced by either of the other two types of schools (Hogben, 1961). This pattern of performance of students from Catholic schools was similar to that reported by Hohne in his earlier studies (Hohne, 1951, 1955). Anderson followed up Hogben's study with an investigation of first-year academic performance of full-time students entering Arts, Science and Medical faculties in 1958, 1959 and 1960. Although entrants from State, Independent and Catholic schools showed few significant differences in intelligence and readings scores, those from Catholic schools had a consistently lower pass rate in first year (Anderson, A. W., 1961).

A study of failure rates in Medicine at the University of Western Australia showed that the greatest wastage occurred in the first two years. Hogben studied the performance during these first two years of 267 students who entered between 1957 and 1960. The failure rate for first year varied from 23 per cent to 41 per cent and for second year from 7 per cent to 19 per cent. Only 57 per cent of entrants reached third year in minimum time (Hogben, 1962).

As quotas had already been imposed on second and third year in 1958 in the Faculty of Medicine, and there was a possibility that a quota would become necessary for the first-year intake, Hogben extended his study to examine the predictive value of various measures at time of entry and to evaluate methods of selection for entry to second year. The data used was that collected from entrants during the years 1957 to 1962, the sample now totalling 376 students. These six intakes showed remarkably similar reading ability, intelligence test score and Matriculation average score distributions, but the correlation of each of these with first-year average score fluctuated widely from year to year. As the university pass rates also fluctuated from year to year, Hogben concluded that there was lack of stability in the success criterion. He considered it impossible to find a good predictor of a poor criterion; hence, selection based on entrance data would inevitably be inaccurate. He suggested that the first need was for some agreement about course objectives, teaching and examining practices within the Medical Faculty (Hogben, 1965).

In 1960, D. S. Anderson and Priestley drew up a report on the study of failure in Australian Universities for the Chairman of the Australian

Vice-Chancellors' Committee. This was the first step towards a subsequent meeting of the Vice-Chancellors on this topic. The summary of the report indicated that academic performance was the outcome of complicated interaction among a large number of variables and that the best known single predictor of this performance was Matriculation scores, but this was far from perfect. Adding scores from other types of tests did not seem to improve the predictive value and it seemed unlikely that better selection was the major solution to the problem of failure. Anderson and Priestley suggested that there was a need to investigate the methods of teaching and examining in unversities and the many non-cognitive factors which appeared to be related to student performance (Anderson, D. S. and Priestley, 1960).

A similar summary of what was known about the incidence and causes of failure at this time was published by Hughes. This article gives the same picture of the situation, pointing to lack of reliability and validity in examinations and inadequate or inappropriate methods of teaching as possible university causes of failure. On the student's side, many relevant factors could be traced to his school background or his family background (Hughes, 1961). In an earlier article, Hughes suggested that, in order to solve some of these problems, the universities would need a more precise formulation of their various functions in terms of the objectives required by the contemporary situation (Hughes, 1960*b*).

In a follow-up to the 1961 article of Hughes, D. S. Anderson suggested some hypotheses about factors which might explain the connection between school background and performance at university. These factors were mainly non-academic ones, but Anderson suggested that they might well account for a great deal of the variation in academic performance. He saw certain practices within the university creating handicapping effects for students with particular background characteristics. If his hypotheses were correct and universities wished to improve their educational efficiency in first year, then they would need to develop appropriate forms of education for such students (Anderson, D. S., 1961).

Flecker appears to have been another of the researchers of this period who did not see improved statistical techniques and better predictors as the most hopeful approach to lowering the failure rate. He undertook two studies of students in which he was seeking to understand the sort of student characteristics referred to by Anderson. In the first one he looked at the characteristics of passing and failing students from the 1957 class in Mathematics I at the University of Western Australia.

The data collected did not reveal any causal connections, but they did provide some information on study methods for this particular subject which could be used for guidance of other students (Flecker, 1959). A second study reported by Flecker looked at the responses to questionnaires given to 50 first-year Engineering students in the same university. Some of the variables studied were satisfaction with school results, difficulty level of first-year university relative to school, perceived instrumental value of each unit of study, perception of class position on tests and practical work and expectations of examiners' standards in the annual examination. It was hoped that the range of responses obtained might be helpful in understanding what comprises normality within the student population (Flecker, 1963).

Two articles which reviewed the current state of research and discussed some of the issues in the early 1960s both indicated that there was growing disillusionment with the prospects of improving pass rates at university by refining selection techniques. In both these discussions, the emphasis moved towards the need for research into teaching methods at university (Hammond, 1962; Sanders, 1963).

In 1961, the Commonwealth Government set up a committee to consider the future of tertiary education in Australia, and this committee produced its report in 1964. This document, now known as the Martin Report, said very little about selection of students, except that university education should be available to all who had the desire and the capacity for it. A Matriculation examination was seen as the means of determining those who had the capacity and raising of the standard of this entrance examination as a means of improving university pass rates was opposed. The committee had not been able to gain much new information about success and failure, but what was available they found disappointing in that it indicated little improvement in the situation over the previous six or seven years. Universities were urged to pay more attention to their teaching methods, to provide for small group learning situations and to ensure some assistance in developing teaching skills for new members of staff (Australia, Committee on the Future of Tertiary Education in Australia, 1964).

The Australian Council for Educational Research prepared two submissions for the Martin Committee. One of these (Turner, 1964) discussed the question: 'What proportion of an age group could undertake tertiary education with reasonable prospects of successful completion?'. In reply to this question Turner supported the view expressed in the Robbins Report and rejected the concept of a 'pool of ability'.

The evidence presented showed that, even in educational circumstances similar to the prevailing ones, a much higher proportion of an age group could have undertaken tertiary education with reasonable prospects of success. The other submission was a response to a request from the Martin Committee to comment on the question: 'What should Universities be able to assume about the qualifications of matriculants, and how can these expectations be met by secondary schools?'. The reply was a statement of what universities could realistically assume about matriculants and what they ought to be able to assume about them given that both secondary schools and universities were willing and able to meet their responsibilities (Radford, 1966).

In 1966, Sanders published a review of the Martin Report, comparing it with the Robbins Report (see Chapter 3) and another British report from the Hale Committee on University Teaching Methods. These committees were all appointed in 1961 and the establishing of the Hale Committee indicated that in Britain this aspect of educational efficiency in universities was already receiving the kind of attention suggested in the Martin Report. The review by Sanders summarizes the findings of these three committees which had investigated related issues at about the same time (Saunders, 1966).

When Monash University presented its submission to the Martin Committee in 1962 it had been teaching for only one year, so that there was some hesitation about generalizing and drawing conclusions from the results of that year. However, the analysis of these results showed remarkable agreement with those obtained from longer studies in established universities. Both product-moment and rank order correlations between Matriculation scores and university results were significantly different from zero, but too low to have much predictive value. The use of Matriculation scores as a criterion for rejecting applicants was seen as neither an efficient nor an entirely fair procedure, particularly in view of the relatively successful performance of the lowest 20 per cent of entrants which occurred in all five faculties. It was suggested that perhaps it was unreasonable to expect lower failure rates at first-year university level, when the public examinations at fourth-, fifth- and sixth-year levels of secondary school had produced failure rates of 35 per cent, 37 per cent and 35 per cent respectively over the five years 1956–60. The submission concluded that, unless some test with three times the predictive value of Matriculation scores was found, there seemed to be no alternative to a policy of provision of university places for all who qualified (Cochrane, 1962).

At Melbourne University, D. S. Anderson looked at the predictive value of both Matriculation marks and headmasters' estimates of student potential for the entrants in 1957, 1958 and 1959. He found little difference between the values of the two predictors and a combination of the two was little better than either of them separately. There was a reasonably direct connection between cut-off score and pass rate in that increasing the cut-off score caused an increase in the pass rate. However, prediction had a high degree of certainty only at the upper performance levels. At the levels where cut-off usually occurred, the probability of success was generally around 50 per cent (Anderson, D. S., 1963).

The candidate's score, which became known as the Anderson Score, was made up of the aggregate marks in three best subjects (excluding English Expression which was not then marked out) plus a bonus of marks in up to four other subjects passed. If the applicant had presented more than once for Matriculation then a per cent reduction was applied to the aggregate from the subsequent attempt. The candidate's score was whichever was the higher of his initial attempt and adjusted subsequent attempts.

Both predictive and educational considerations were used in devising the formula. Research had shown that aggregate marks from a subsequent attempt at Matriculation were on average greater than from a first attempt. This average increase included a real educational gain in terms of probable level of university performance from spending more than one year at Matriculation, plus a component which over-estimated the level of university performance compared with a similar total of marks from a first attempt. The percentage reduction of marks from a subsequent attempt was therefore calculated to remove the relative over-estimation but to leave the real gain. In the early years when the formula was used the per cent reduction was around five per cent but Anderson recommended that the size of the debit be reviewed annually after statistical analysis of the most recent results. The bonus for subjects passed in addition to the prescribed minimum was included as an incentive, consistent with the aims of most educators at the time, for students to broaden their studies. The bonus had no predictive value and its size needed to be only so large as to honour a statement such as 'Recognition will be given to subjects passed in addition to the prescribed minimum'. In his original paper and in a subsequent one Anderson outlined a more complex version of the formula in which allowance was made for the size of the improvement between subsequent

attempts and for differences between subjects taken at sixth form and university (Anderson, D. S., 1964, 1969).

This original formula for the Anderson Score was used to select the 1966 intake at Monash University. Biggs calculated the correlation coefficients for these scores with first-year examination results for each of the six faculties, the total number of students being 1561. The coefficients varied from 0·409 in Arts to 0·627 in Science for those entrants who had only one attempt at Matriculation. The groups of students who had attempted Matriculation a second time produced poorer correlation coefficients in Arts, Ecops (Economics and Politics) and Law, but higher coefficients in Engineering, Medicine and Science. Biggs repeated these calculations for twenty-two variations of the formula and concluded that different formulae were the best predictors in different faculties. This original form of the Anderson Score was best for Science and Ecops, but slight variations of it improved prediction in other faculties. One interesting result was obtained by the Medical Faculty, where the New Anderson Score formula produced the best correlations. This new formula increased both bonuses and penalties from 5 per cent to 10 per cent and included an additional penalty which increased with the magnitude of failure in English Expression (Biggs, 1967).

The Anderson Score formula was altered and adapted by various faculties in Victorian tertiary institutions during the late 1960s and early 1970s, but searching for better predictors was no longer seen as the most likely solution to the problem of high failure rates. Anderson himself published several articles during this time in which he pointed out the limitations of all attempts to predict and some of the undesirable backwash effects on secondary education. Competitive entry to university meant that the objective of many senior secondary students became one of maximizing their point score. This often influenced their choice of subjects, as they selected what they thought (or their teachers thought) to be the 'soft options'. It also gave an examination-centred orientation to their learning during their final years at school. This was not necessarily good preparation for university study (Anderson, D. S., 1965, 1966, 1970). He suggested some of the pressures might be taken off the schools and their sixth-form pupils if the entrance test was changed to a scholastic aptitude type, similar to that used in the USA and Canada. However, he did not anticipate that the predictive value of this would be any better than that of Matriculation examination scores for school leavers (Anderson, D. S., 1966). On

the other hand, there was some evidence that it would be a better predictor for older applicants who were further removed from school.

In an earlier article Anderson went further and questioned one of the underlying assumptions of some people supporting continued selection for entry to universities. This was the concept of 'a fixed pool of ability' as it had become known in England. The Robbins Committee had gone to a lot of trouble to refute this idea of a strictly limited amount of intellectual ability in society. Anderson pointed out that he had collected evidence that there were many able children who were not even getting close to university education (Anderson, D. S., 1965). These were the people that Selby Smith later referred to as the real wastage in the community and suggested that, as they were less obvious and cost nothing, by comparison with the failing university student, they were of less concern to governments (Selby Smith, 1969). In a more recent article, Anderson suggests that the universities are administering a social competition and any one of a wide range of admission tests would select a group with much the same social composition and academic potential. Applicants merely adapt their behaviour to maximize their chances (Anderson, D. S., 1972).

These articles by Anderson quoted summaries of figures on pass rates and prediction from which he concluded that a global score based on Matriculation results was the best predictor, but correlation coefficients seldom reach the level of 0·60. The correlation for other types of tests approached that for Matriculation as their content approached that of the Matriculation examinations. This was because this type of content was closest to that taught and tested at universities. Combining scores from other types of tests with Matriculation scores seldom improved prediction, because performance in school examinations was already sensitive to environmental and personality factors and to some extent examination marks represented an encapsulation of the student's life history (Anderson, D. S., 1972). Anderson saw little prospect of improving prediction and selection to a point where it would resolve the failure rate problem.

> Trying to account for academic performance is like trying to nail red-currant jelly to a wall. (Anderson, D. S., 1970, p. 66)

He saw suggestions that the university should increase its efficiency by admitting only those who were not going to fail as equivalent to suggesting that the efficiency of the army could be increased if it recruited only those who were not going to be shot. Much greater hope was held out for solutions which involved inprovements within the university.

Improving staff skills and attitudes in order to bring about better teaching and learning, and a more reasonable attitude to pass rates was seen as an essential prerequisite to raising levels of performance at university. Another problem was large lecture groups, particularly in first year, and the consequent breakdown in communication between staff and students. More small group teaching seemed desirable (Anderson, D. S., 1965, 1970, 1972).

Selby Smith also took issue with those who supported more rigid selection for entrance to universities. He pointed out that there were many successful graduates making worthwhile contributions to the community who entered universities in earlier non-selective times, and would probably not have been admitted had they been subjected to the selection procedures of the 1960s. The alternative to selection was increased numbers of students and many predicted that this would cause dilution of student quality and lowering of university standards. Selby Smith questioned this and suggested that failure rates did not seem to be highly related to numbers or proportion admitted, and there was some evidence that pass rates were extraordinarily stable, even when calibre of intake was changing. The solution to the problem of wastage would more likely be found in ensuring that students found their way into the most appropriate courses and institutions. Greater opportunity to transfer from one tertiary institution to another would help to rectify wrong decisions which would otherwise lead to failure, but provision of better counselling and guidance could prevent many such potential failures. Progressive guidance towards a suitable career might prove more successful than trying to pick good students at particular stages (Selby Smith, 1969, 1971).

In the search for solutions to the wastage problem there appeared to be three main approaches emerging. There were some who continued to investigate tests and methods of selection, others turned their attention to better guidance of students at both secondary and tertiary levels, while another group pressed for improvement in teaching and learning within the universities. Maclaine was one of this last group who set out a programme of increasing competence of staff, reviewing courses, smaller learning groups, improved learning techniques, clearer statement of objectives, more reliable and valid examinations, special assistance for first-year students with identification of those at risk and assistance for them (Maclaine, 1965).

As a consequence of a resolution passed at the 1960 Conference on University Education convened in Melbourne by the Australian Vice-

Chancellors' Committee, the Commonwealth Office of Education agreed to undertake a study of the progress of all students entering Australian universities in 1961. The study continued until 1967 but the report was not published until 1971 (Australia, Department of Education and Science, 1971). This study was mainly concerned with a description rather than an explanation of student performance, but it did comment on the Matriculation examination as a predictor of university performance. Of the 8599 full-time students who entered the eleven universities in 1961, 64 per cent had graduated by the end of 1967, although only 37 per cent did so in minimum time. For students who entered universities ten years earlier, the corresponding figures were 58 per cent and 35 per cent. Correlations were calculated between Matriculation scores and first-year passes, minimum time graduation and total graduation. Most of these correlation coefficients were in the range 0·3 to 0·4. These were even lower than those reported in earlier studies.

This report produced the most comprehensive set of data ever collected across all universities in Australia. One of the most interesting tables showed the effect of using Matriculation scores as a selection device in order to improve graduation rates. In order to achieve the 80 per cent graduation rate suggested by the Murray Committee it would have been necessary to reject more than half of the 1961 entrants in most States, and yet, in most cases, the graduation rates of the 'rejected groups' exceeded 50 per cent. Achieving the 60 per cent minimum time graduation rate suggested by the Martin Committee would have required an even more drastic cut-back in admissions. Both these situations would have resulted in a loss of several hundred graduates. Even raising the graduation rate from 64 per cent to 70 per cent would have caused a loss of 340 graduates (Australia, Department of Education and Science, 1971). It appeared that Sanders had assessed the situation accurately before the 1961 study even began when he said

> . . . something like an academic revolution in Australia would be needed to approach the target suggested by the Murray Committee. (Sanders, 1958*a*, p. 37)

While the 1961 study was proceeding the debate on selection, failure and wastage raged on. In 1968 the Vice-Chancellors' Committee sponsored a working paper on the factors relating to the admission selection and progress of the Australian university student. This was intended to set out the many complexities involved in these issues. The paper not only set out the situation as it currently existed, but it con-

cluded with a summary of the issues in the form of questions which needed to be answered (Mitchell and Cohen, 1968).

A few months after this paper was published one of the Vice-Chancellors gave his answers to some of the questions in an address on academic wastage. Baxter insisted that the onus was on the universities to succeed with the students they admitted. He said they must accept accountability not only to the government for the money they spent, but also to the community for the extent to which they met the demands and needs of that community. This accountability, he believed, could be expressed in terms of the minimum spoilation of first-class raw material, the first-year students being the raw material and the failure to turn them into graduates the spoilation (Baxter, 1970).

At the time of writing that article Sir Philip Baxter was the Vice-Chancellor of the University of New South Wales and it was in that university, in the same year, that a longitudinal study of student characteristics and performance was commenced. This study commenced with the 1969 intake and its first report analysed the background and characteristics of these freshers. This analysis revealed great diversity in terms of socio-economic status and educational attainment of the family of origin, home residence, type of school attended, educational and occupational aspirations, and academic attainments. There was also evidence of major differences in general values and beliefs within the group. Although most of these students were the first members of their families to attend a university and they viewed the university as a means of qualifying for a vocation with high income and high status, they did express high educational aspirations and definite ideas about what the university could and should provide. However, approximately half these students did not succeed in passing all the subjects for which they enrolled, although this total success rate varied from 65 per cent in Medicine down to 35 per cent in Arts and Vocational Studies. This study did not set out to find a better predictor but it did look at the correlation between Higher School Certificate examination and success in first year, finding this to be significant in all faculties. However, only in the faculties of Applied Science (0·68) and Science (0·62) was the correlation considered high enough to justify the use of HSC scores for selection of students. The main objective of this research was to clarify relationships between various characteristics of students and their performance and to identify those characteristics which may facilitate or impede adaptation to the university (Katz, Barrett and Firth, 1970).

In a more recent report on these students second-year performance was analysed. The correlations between HSC and second-year results were even lower than those obtained with the first-year results, but correlations between first- and second-year results were, in general, higher than either of the correlations with HSC (Firth, 1972).

Two and a half years later, in October 1971, the surviving 60 per cent of students from this 1969 intake group were invited to participate in a follow-up survey to ascertain their reaction to the university. The high aspirations expressed in 1969 had now dropped to a lower and possibly more realistic level. The university experience had not lived up to their expectations and, although the students were prepared to concede that this was perhaps due to their idealistic views as freshers and their own shortcomings as students, they were very critical of the educational process. Disappointment with the university was associated with the low quality of teaching and the high demands of teachers and courses, the latter also being seen as at least partly to blame for the minimal participation of students in extra-curricular activities. It appeared that many of the generally accepted purposes of a university education were not being achieved for the majority of students (Katz and Barrett, 1972).

The 1960s saw a shift in emphasis and a change in attitudes towards the problems of selection and wastage. The mainstreams of thinking which had emerged were reflected in three papers given at a seminar organized by the Western Australian Tertiary Education Commission in 1971. Blakers, Williams and A. W. Anderson all discussed some possible improvements in selection techniques but pointed out the limitations of this approach and none of them saw this as the real solution to the problem. Blakers suggested that the University should accept responsibility for early detection of those at risk and it should provide assistance and guidance for those with either academic or personal problems (Blakers, 1971). Williams recommended improved guidance of students to assist them in developing skills of decision making together with greater opportunity for the non-motivated to opt out without prejudicing their chances of re-entry later on (Williams, 1971). Anderson suggested that improvement in selection was almost impossible until the criteria for success within tertiary institutions were made more stable and were properly assessed. Those students who appeared to be most at risk were those who showed high potential and low performance at entry, but a tertiary institution could improve the success rate of these students if it deliberately organized experiences designed to rehabilitate them (Anderson, A. W., 1971).

All these papers seemed to shift the onus for improving pass rates at tertiary level on to the tertiary institutions. There appeared to be an acceptance of the selection process as one which, although far from perfect, was producing a group of students capable of higher success rates at tertiary level. Williams summed it up by suggesting that

> . . . if we want to achieve the efficient use of our resources we should look to an approach in terms of output and productivity rather than input. (Williams, 1971, p. 12)

CHAPTER FIVE

THE DEVELOPMENT OF AUSTRALIAN SCHOLASTIC APTITUDE TESTS: TEEP AND ASAT

The Beginnings of TEEP

When Rechter and Wilson published their review of current practices in examining for university entrance in Australia in 1968, achievement tests were being used in all states. The article gave a clear picture of the setting, marking and grading procedures as well as some of the research findings on this type of examination. There appeared to be no reason to believe that the reliabilities of the marking procedures would be any better than those reported from overseas studies, and these were not very high (Rechter and Wilson, 1968).

As a result of the Murray Report in 1957 and the Martin Report in 1964 attention had been focussed on student failure and wastage. In no state did the university entrance examination have good predictive power and the universities were looking for better selection devices. In 1967 the University of Western Australia, the Australian National University and the Department of Education in Tasmania made a submission to the Commonwealth Department of Education and Science for funds to explore the possible use of an aptitude-type test battery in the selection of students for tertiary education.

This idea was not new to the Commonwealth Department, for it had already conducted a series of five trials with College Entrance Examination Board (USA) tests in New South Wales and Victoria between 1951 and 1953. The two sub-tests of the verbal section of the Scholastic Aptitude Test and the four sub-tests of the Comprehensive Mathematics Test had been chosen as a possible scholarship selection medium which would be standard throughout Australia for the purpose of awarding Commonwealth Tertiary Scholarships. One of the aims of this testing programme was to examine the reliability and validity of these tests under Australian conditions. Split-half reliabilities appeared satisfactory for the two verbal tests and one of the mathematical tests. Validity was tested by calculating the correlation of each paper with the corresponding subject in Leaving Certificate. Considering that the material

tested in Mathematics I and II went far beyond that tested in the CEEB tests, the correlations for these tests were about as high as could be expected. For the verbal tests and the English examination the correlation coefficients were a little lower, but this may have reflected an even greater difference in skills being tested. Total scores on the CEEB Mathematics Test were found to predict university success in Pure Mathematics I just as well as scores in Leaving Certificate Mathematics I and II. For university Applied Mathematics the CEEB score was the better predictor (Australia, Commonwealth Office of Education, 1959).

In 1968 the Commonwealth Department of Education and Science commissioned the Australian Council for Educational Research to develop an aptitude-type test battery suitable for use in a projected study of tertiary selection. The project became known as the Tertiary Education Entrance Project or TEEP and the first battery of tests, TEEP Series A, was ready for use later that year. In 1969 new tests were substituted for some of the Series A tests and the new battery was called Series B. Further modification in 1970 produced Series C but that year also saw the production of the first of the Australian Scholastic Aptitude Tests (ASAT). The background to TEEP and the construction of this first test battery are set out in *Admission to Tertiary Studies* (Rechter, 1970).

The TEEP Experiment in the Australian Capital Territory

The first testing using Series A was in 1968 and it involved all final year secondary students in the Australian Capital Territory, in Tasmania and in Western Australia. The TEEP tests were designed along similar lines to the tests developed by ACER for the Commonwealth Secondary Scholarships Examination (CSSE). In the Australian Capital Territory students who sat for TEEP in 1968 had taken the CSSE in 1966 so it was possible to look at the correlations between these two sets of scores. When the corresponding papers were compared the correlation coefficients ranged from 0·538 for the essay tests to 0·700 for Science (Australia, Department of Education and Science, 1970).

The main interest in the TEEP experiment was not looking backwards at CSSE but looking forward to performance at tertiary level in order to study the extent to which TEEP tests could select those students most likely to succeed. The interim report on the evaluation of TEEP published by the Department of Education and Science in 1971 gave a detailed analysis of the data for the ACT and discussed some of the methodological and statistical problems associated with such an

analysis. Correlation coefficients were limited by the truncation of the lower ranges as a result of tertiary selection and the erratic performance of students in the upper ranges of ability. The assumption that two sets of scores were equivalent measures on the same variable was often suspect, particularly when scores were combined to give 'total TEEP score' or samples were combined across different faculties. Hence an alternative analysis was also given. This divided the university students into two groups, successful and failing, and then looked at the mean TEEP scores for the two groups. However it was pointed out that differences in means were deceptive because of the overlap of the two distributions and this was not seen as a basis for prediction of tertiary success.

In the correlational analysis the values of the coefficients were quite low, generally of the order of 0·3 or less, except for students in the Arts Faculty whose results correlated 0·54 with TEEP Paper 5 (Humanities) and 0·50 with TEEP Total. Correlations of tertiary results with Higher School Certificate scores were rather better, most lying in the range 0·3 to 0·6. The biggest difference between correlations with TEEP and with HSC were in the Science Faculty where total of best five HSC subjects gave a coefficient of 0·65 compared with 0·35 for TEEP Total. Teachers' estimates correlated a little less than HSC but still considerably better than TEEP. Looking at the differences between the means for passing and failing students, it was found that in the two largest faculties, Arts and Science, the aggregate of the best five HSC subjects was the only measure to give reasonable discrimination. For the Arts Faculty alone TEEP Paper 5 and TEEP Total also discriminated reasonably well.

From the evidence produced in this report it was concluded that HSC English and best five HSC subjects total were the most successful predictors. TEEP papers were erratic and the Quantitative and Science papers gave poor prediction for Science students. On the whole, TEEP Series A was less successful than HSC in predicting university performance in 1969, although neither measure proved satisfactory (Australia, Department of Education and Science, 1971).

The TEEP Experiment in Tasmania

Tasmania took part in the first stage of TEEP testing with 69 per cent of Matriculation students sitting for all papers in the TEEP Series A battery. The second TEEP report from the Tasmanian Education Department gave an analysis of these TEEP scores and their cor-

relations with HSC results (Tasmanian Education Department Interim Report on TEEP, No. 70/1). The fourth report was a detailed analysis of correlation between scores on University Pure Maths I, HSC Maths A and TEEP tests for the 49 students who had a complete set of these scores. University Pure Maths I correlated 0·58 with six hours of testing in HSC Maths and 0·52 with the one and a quarter hours of testing on the Quantitative paper (Paper 1, P1) in TEEP. As the standard deviation of P1 scores was approximately half that of the Maths A scores, the P1 score was combined with half the Maths A score to give the two tests approximately equal weighting. This gave a multiple correlation of 0·65 which was higher than either of the separate score correlations. The highest value of the multiple correlation obtained by using optimum weightings was 0·67 and the weighting factors obtained from a multiple linear regression equation were 0·41 and 0·76 which were close to the 1 : 2 ratio used in the earlier approximation. It appeared that in this particular subject this simple combination of the relevant HSC and TEEP scores could provide a better predictor (Tasmanian Education Department Interim Report on TEEP, No. 70/3).

When ASAT was developed in 1970 the Education Department of Tasmania decided to administer it to their student teachers entering Hobart Teachers College, Launceston Teachers College and the University of Tasmania in 1971. An interim report issued in May 1972 deals with 131 of these students who commenced studies at the University, 42 of them in Science and 89 in Arts. Correlations between ASAT and first-year results, both overall and separate subjects, were very low. There was an interesting attempt to divide the ASAT test into sub-tests to produce scores on particular skills but these also produced very low correlations (Tasmanian Education Department Interim Report on TEEP, No. 72/4).

The TEEP Experiment in Western Australia

The University of Western Australia has not only participated in the TEEP experiment from the beginning, but it has continued systematic testing for a number of years, producing frequent reports with detailed analyses of results. Most of this work has been done by A. W. Anderson for the Research Unit in University Education.

The first group of students tested were those entering the University in 1969 after having taken the School Leaving Examination in 1968 or the Matriculation Examination in 1969. These 1109 students were also tested on the Co-operative Reading Test and the ACER B40 Intelligence

Test, as well as TEEP Series A. Correlations were calculated for each of these scores with separate subjects at first-year level. Although many of the correlations were statistically significant they were lower for TEEP, Intelligence and Reading Tests than for School Leaving subjects, particularly when the School Leaving subject and university subject were the same or closely related. It appeared that the best predictions would come from School Leaving results, but even these would not be satisfactory (Anderson, A. W., 1970*a*).

When this exercise was repeated the following year the Leaving Examination included two levels of papers, one for Leaving and the other for Matriculation, and new Matriculation Regulations for entry to the University were operating. The first reports produced on these students in 1970 were concerned with looking at this new situation and the Leaving and Matriculation level subject intercorrelations (Anderson, A. W., 1970*b*). When first-year university results were analysed, students were divided into two groups, those passing all subjects and those who failed in one or more subjects. Biserial correlations were calculated for these categories against aggregate scores on Leaving, Matriculation and TEEP Series B. Leaving and Matriculation aggregates showed significant relationships with performance, but the TEEP aggregate gave much lower correlations. This was seen as confirming earlier evidence that ability measures were not good primary predictors of performance. Leaving and Matriculation aggregates were performance measures and were therefore likely to be better predictors of first-year performance (Anderson, A. W., 1971*a*).

In this last report it had been suggested that selection should be looked at in terms of pairs of aggregates rather than using only one measure for determining the cut-off point. This was done in a subsequent report by arranging a scattergram for the three different pairs of aggregates. When the selection was based on a combination of cut-off scores on these two measures, the prediction appeared to be better than that produced by either cut-off alone, especially when the two variables were performance measures. The combination of TEEP aggregate with either Leaving or Matriculation aggregate was not as effective as the Leaving–Matriculation combination. A selection procedure based on this method should reduce failure rate in theory, but in practice this would only be achieved if educational patterns and procedures in first year were related to prior performance and student ability (Anderson, A. W., 1971*b*).

In the third year of testing (1971) ASAT replaced the previous TEEP

batteries, but these scores still correlated poorly with first-year results. Biserial correlation coefficients of passing/failing in first year with Leaving, Matriculation and ASAT aggregates were 0·57, 0·52 and 0·32 respectively. This result was not encouraging for those who saw ASAT scores as a basis for tertiary selection. Although the other two correlations are higher they are still not good enough for prediction purposes. The report states that the Matriculation scores were scaled using the ASAT scores, but there is no discussion of either the effect of this or the rationale for doing it (Anderson, A. W., 1972*a*).

The same scaling procedure for Matriculation scores was used the following year, that is, for students sitting for Matriculation in 1971 and entering the University in 1972. The same systematic analyses of Leaving, Matriculation, ASAT and first-year results were carried out, the first-year results correlating 0·61, 0·52 and 0·25 respectively with the other three scores. An Admissions Aggregate which was calculated by combining Leaving and Matriculation scores gave a correlation of 0·58 with first-year results. Correlations based on performance scores were thus the same or a little higher than those in the previous year, but the correlation for ASAT scores dropped to an even lower value (Anderson, A. W., 1973*a*).

Although both the Matriculation Regulations and the method of calculating Admissions Aggregate had changed over the years 1969 to 1973, the data that had been collected for the above analyses enabled Anderson to show that, judged by the mean value of the Leaving Aggregate, the group of entering students had not changed in calibre during these years. Some faculties had shown apparent differences across the years, but sample sizes were small in some of these and the only significant differences were in Arts and Commerce (Anderson, A. W., 1973*b*).

In 1970 an exploratory survey was carried out on school estimates of student performance. Thirty-nine metropolitan high schools and two country schools provided estimates for 2394 students. Using a nine-point scale schools were asked to give three estimates of performance, one for the 1970 Leaving/Matriculation examinations, one for first-year studies in a university science-type faculty and one for university studies in a humanities/social science-type faculty. Schools were also asked to indicate the basis for their ratings so that schools showing high level accuracy could be examined for similarities in procedure. An interim report published in 1971 compared school estimates for Leaving/Matriculation examinations with actual results. These showed that

school estimates were generally high, predicting higher percentage pass rates than those which actually occurred (Anderson, A. W. and Collins, 1971).

A later report in 1972 was able to compare estimates of university performance with first-year results. This again showed that most schools overpredicted success, some much more than others. Also schools seemed to estimate more accurately for performance in Science than in the humanities/social science area, correlations between school estimates and actual results being 0·57 and 0·49 respectively. However correlations for first-year results with Matriculation scores for these same faculty groupings were 0·67 and 0·53 respectively. Thus school estimates alone did not seem to provide a basis for better selection and prediction (Anderson, A. W., 1972*b*).

One possible way in which school based data might be used was in conjunction with ASAT. Anderson suggested that ASAT scores could be used to moderate school estimates. He suggested that sufficient data had been collected to try out various methods of combining ASAT and school data and testing the predictive validity of the composite measures. He saw this as the most promising substitute for the Matriculation Examination should external examinations be abolished (Anderson, A. W., undated).

The TEEP Experiment in Queensland

The TEEP tests were first used in Queensland for testing first-year university students in Medicine, Dentistry and Social Work in the first week of the 1969 academic year. Correlations were calculated for first-year university results with each of Matriculation scores, TEEP Series A scores and teachers' estimates. These correlations were generally low and sample sizes were too small in Dentistry and Social Work for conclusions to be drawn. Attempts to deduce mathematical models or equations for prediction did not yield promising results and no significant role for TEEP scores emerged from this study (Bassett, Carss and Power, 1970).

In 1970 the Research and Curriculum Branch of the Department of Education began a major research study to investigate the relative effectiveness of possible alternative methods of selecting students for entry to tertiary institutions in Queensland. This became known as the Grade 12 Study. Virtually all Grade 12 students in Government and non-Government schools in third term of 1970 were given a battery of tests including ASAT. The total number of students who took the

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ASAT was 7737. The size and representative nature of this sample has provided an excellent set of statistics for comparison. Tables have been produced for ASAT scores classified by sex of students, type of school attended, type of course studied at school and location of school. In addition to total ASAT scores, sub-scores linked with particular abilities were analysed. The reliability coefficient for the test as a whole was 0·83 and the distribution of raw scores was very close to a normal distribution. These results were encouraging as this was the first large scale use of this test (Queensland, Department of Education, Research and Curriculum Branch, 1971).

Some interesting analyses of the distributions of both ASAT scores and Senior Examination Aggregate scores have been done for these students. Separation of student groups according to tertiary institution entered in 1971 shows considerable overlap of ASAT scores for University students, Institute of Technology students and Teachers College students. The overlap is reduced when these three groups are compared on Senior Aggregate. Comparisons of distributions of scores have also been done for students taking the same type of course in different institutions and for students taking different courses in the same institution. These graphs showed that neither ASAT nor Senior Examination discriminated clearly between the groups of students entering different tertiary institutions or different courses of study (Wood, 1971).

What A. W. Anderson had foreseen as possible future developments in Western Australia became realities in Queensland in 1973. The external Senior Examination having been abolished, a system of teachers' assessments scaled against performance on ASAT was introduced to compile an Order of Merit list for use in tertiary selection. The Queensland Board of Secondary School Studies issued two documents. One was a statement of the procedures to be followed in collecting the data and compiling the Order of Merit list (Queensland, Board of Secondary School Studies, 1973*a*). The other was a paper explaining the rationale underlying the proposed procedure and giving some analyses of results from the Grade 12 Study which were relevant to the use of ASAT for rescaling. Within school and between school correlations were given for Aggregate School Assessment with ASAT Total, three ASAT sub-scores, TEEP Total and six TEEP sub-scores. The highest within schools correlations were those for total scores on ASAT (0·51) and TEEP (0·62). Although TEEP Total had the better correlation, it required six tests taking a total of 9 hours 20 minutes to

obtain this score, whereas ASAT was a single three hour test. Hence the greater validity had to be weighed against the cost and effort of achieving it. The between schools correlation for Aggregate School Assessment with ASAT Total was 0·19 indicating that there was a need to rescale school assessments. Also it was necessary to iron out variations in standards from subject to subject as well as from school to school. Hence the rescaling procedure was a complex one in which ASAT scores were to be used at two levels, firstly to rescale assessments in separate subjects and finally to rescale aggregate scores (Queensland, Board of Secondary School Studies, 1973*b*).

The TEEP Experiment in Victoria

Although no large scale administration of TEEP tests or ASAT was carried out in Victoria until 1973, TEEP Series A was used as part of the College Scholarship Examination at Melbourne University in 1968. Of the 450 candidates taking this examination, 287 entered the University in 1969 and in 1971 the Centre for Study of Higher Education used this group for an evaluation of the examination as a selecting device. These 287 students were by no means a typical sample of the university intake as a whole in terms of either socio-economic backgrounds or prior school experience. Hence it would be dangerous to generalize from the results of this study. However, for this particular group it appeared that correlations for all types of predictors used with university performance were low, the highest being around 0·6 for Quota score with first-year results. Most other correlations were around 0·3 or less. Quota score appeared to be the best predictor but its correlation with second-year results dropped to 0·5 or less and at third-year level it was down to 0·3. Adding TEEP total to Quota score added nothing to the predictive value (Gilchrist and MacMillan, 1973).

A similar analysis was carried out on a corresponding group of 264 scholarship applicants who entered the University in 1970. The correlation coefficients were similar in pattern to those of the previous study with the TEEP scores correlating only slightly higher with university results in this second study. Two TEEP sub-scores were identified. One was significantly related to later university performance in science courses, but did not predict to performance in humanities courses. The other predicted moderately well to performance in humanities courses and less well to performance in science courses. The first-year results in humanities-based courses gave correlations of 0·42 and 0·48 respectively with the TEEP Humanities sub-score and Quota

score. For science-based courses the corresponding figures for the TEEP Science sub-score and Quota score were 0·46 and 0·75. It was suggested that a general competence measure such as a TEEP sub-score was probably a reasonable substitute for Quota score when the university subjects were not closely linked in content with those taken at HSC. In science-based courses content often followed on from that studied for the HSC examination, hence Quota score was likely to be a better predictor of university performance (Gilchrist, 1974).

CHAPTER SIX

SOME NON-COGNITIVE FACTORS IN SUCCESS AND FAILURE

The work of Himmelweit and Summerfield has already been referred to in Chapter3 where the discussion focussed on the relationships between cognitive factors and success revealed in their work. This study also looked at some non-cognitive factors although Himmelweit, in reviewing the literature, admitted that prediction of the non-intellectual factors making for academic success had proved difficult. While the use of personality tests for purposes of selection were not advocated, the results of earlier studies were seen as sufficiently encouraging to warrant further investigation (Himmelweit and Summerfield, 1950–51, I). The second instalment of this report described the testing program which included six measures of personality. Of these, the only one which correlated significantly with the criteria of performance in final degree examination was the Index of Accuracy. Although most of these tests had been useful elsewhere in detecting gross differences in degree of adjustment, they did not prove sufficiently sensitive to detect the minor differences in adjustment in the relatively homogeneous group of students at the London School of Economics (Himmelweit and Summerfield, 1950–51, II).

A third part of this report concerns a study of over- and underachievers. A discrepancy score was calculated for each student by subtracting his standardized cognitive tests score from his standardized examination results. By selecting from the sample of 232 students those whose discrepancy score was more than one standard deviation from the mean, 40 overachievers and 40 underachievers were identified. When these two groups were compared no difference was found between them in age, intelligence, type of school attended, socio-economic background, size or stability of family, father's occupation or educational level of parents. Nor was there any difference in personality structure or adjustment as measured by the six tests. However, the underachievers tended to be less well informed in fields not directly connected with their studies and to be more restricted in their interests,

taking less part in the life and activities of the university (Himmelweit and Summerfield, 1950–51, III).

One of the most comprehensive Australian studies of this type was that carried out at the University of New England between 1961 and 1964. During these four years a total of 1011 students entering four faculties took part in the study. Information of many different kinds was collected and correlations were calculated with first-, second- and third-year results. The highest correlations were between Matriculation scores and first-year results, but even these were only around the 0·5 value, varying from faculty to faculty and year to year. These correlations were not considered good enough for purposes of prediction. All these correlations dropped in second year and were no longer even significant in two of the four faculties. Other cognitive tests of verbal ability, logical reasoning and critical thinking showed very poor relationships with even first-year results and no relationships could be found between success at university and socio-economic background, level of education of parents, location of home or type of school attended. These results did not agree with those of some other studies done in other Australian universities, but this may have been due to the fact that the University of New England was a small, largely residential university in a rural area. The problem of adaptation to the University was quite different from that experienced by students attending one of the larger city universities.

Although several measures of personality factors were taken none of these correlated significantly with even first-year results. In addition to all the factors already mentioned, this study investigated the attitudes, interests and social life of students in an attempt to find factors which were related to academic performance. The conclusion reached was that success or failure could not be predicted with confidence from previous examination results, background circumstances or any of the tests used in this study (Katz, Katz and Olphert, 1965).

At the University of Lancaster tests were developed for measuring motivation, study methods, examination techniques and lack of distractions. These tests had test–retest reliabilities of about 0·8 and three different approaches to establishing validity produced confirmatory findings. However none of these measures had high correlation with academic performance. Motivation and study methods correlated significantly with A-level results and had even higher correlation with academic performance at tertiary level, but examination techniques and lack of distractions correlated more closely with school attainment than

academic performance. This meant that the latter two measures were unlikely to be useful for improving prediction, but the scales of motivation and study methods looked more promising (Entwistle *et al.*, 1971).

In 1967–68 a survey was carried out on all first-year students at the University of Edinburgh. Seventeen hundred students completed two questionnaires, one at the commencement of first year, the other six months later. Many factors both cognitive and non-cognitive were included. No significant correlation with academic performance was found for background factors such as sex or marital status of student, civil state of the parents, birth order, mother's attitude towards the student coming to university, commitment to a future career, type of school, interest in clubs and societies or sport at school, happiness at home, hostility or direction of hostility. In the second survey it was found that type of residence, number of friends of same sex, reported physical illness, reported consultations for either physical illness or emotional disturbance and contact with directors of students and teaching staff did not correlate significantly with academic performance at the end of first year. The factors which did correlate significantly were school achievement score, type of school-leaving certificate, satisfaction with school performance, age, nationality, attitude towards coming to university and religious participation. These seven factors were used by Kapur to construct two Simple Prediction Scales, one for males and one for females. A Multiple Regression Scale was also constructed but the Simple Prediction Scales were considered more appropriate and easier to administer. Had the scale for male students been used it would have identified as 'at risk' 129 out of the 229 who either failed or dropped out. It would also have placed 220 of the 826 who passed in the 'at risk' category. This would have placed approximately one third of the students on the list for remedial help but Kapur considered that the task of dealing with these was worth the effort if it could prevent even half the failures and drop-outs (Kapur, 1972).

The studies cited here are only a small selection of a wide range of investigations into non-cognitive factors, but the main emphasis of this review is on studies of cognitive factors and this section is included only to indicate the type of work which has been done in a closely related area. Although many of the studies have attempted to identify non-cognitive factors related to student failure and wastage, none of them appears to have found criteria which could be used at the point of selection to improve the prediction of future academic success or failure.

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CHAPTER SEVEN

THE CONTINUING DEBATE ON SELECTION

In spite of the growing emphasis on other aspects of the student wastage problem, the search for better predictors and more refined statistical techniques continues. A major improvement in the standardization procedure for HSC scores has recently been introduced in Victoria (Whittle, 1971). The Tertiary Education Entrance Project in Victoria carried out large-scale testing in 1973 and is currently analysing the data collected. Parallel to this study there is a two-pronged investigation into teacher assessments as an alternative selection device. The Monash Computer Centre has done some analysis of their data comparing teacher assessments with HSC scores (Bainbridge, Bellamy and Whittle, 1974), but the study being carried out by the Victorian Universities and Schools Examination Board, which is a longitudinal study following students through to tertiary level, is not yet complete, so no conclusions are yet available about the predictive value of teacher assessments.

Concern about the method of selection being used and its effectiveness at La Trobe University was expressed in a report by the Education Committee of the Academic Board of that University. This Committee looked at the Anderson Scores of 1681 students in the schools of Agriculture, Biological Sciences and Physical Sciences and concluded that the correlation with first-year results was reasonable for those students with Anderson Scores greater than 180. The correlation was highest for those with very high Anderson Scores, but for those with scores below 180 the correlation was so low that it had negligible predictive value. In the School of Physical Sciences 34 per cent of students graduated in minimum time, while a further 19 per cent graduated in one additional year. These figures are remarkably similar to those obtained in *The 1961 Study* (Australia, Department of Education and Science, 1971), namely 36 per cent and 16 per cent respectively for Science students (La Trobe University, Education Committee of the Academic Board, 1973).

Criticism of the backwash effects on secondary education of content-based examinations such as HSC has caused some writers to look

seriously at alternatives. Rechter has suggested general achievement tests for those faculties which assume some pre requisite knowledge for their courses (Rechter, 1972). Others have pinned their hopes on the TEEP batteries or ASAT, but Berkeley and Alford have raised some doubts about the possible use of ASAT-type tests for selection and prediction purposes. Their study, based on CSSE and School Junior Examination in Queensland, shows little more than 50 per cent overlap between the rank-order lists based on these two different types of examination with the Junior appearing to have the better predictive value (Berkeley and Alford, 1974). Sutherland's report of testing with TEEP Series A and ASAT in the Australian Capital Territory and Western Australia has indicated that these tests will not be suitable as the main criteria of selection for a university course (Sutherland, 1974).

At the secondary–tertiary interface pressures have been building up as a result of changes at both secondary and tertiary levels. The development of a wide range of tertiary institutions and the increasing numbers of students staying on to complete secondary education have made the testing and selecting process a much more complex one. Attempts have been made to modify the public examinations at this level in most Australian States. Radford has reviewed these changes alongside similar trends in New Zealand and Scotland, setting each development in its historical perspective (Radford ,1974). Rechter, in his discussion of recent changes in public examinations in Australia, suggested that it was time to evaluate whether the effort and funding of these examinations was effective (Rechter, 1974).

The Victorian Universities and Colleges Committee has taken steps to have the Victorian Universities and Schools Examinations Board replaced by another representative body which may be better suited to handling assessment and selection in the changed patterns of education at secondary and tertiary levels. While the proposals for this new body give it a role which is largely advisory and supportive, it is also charged with the responsibility for conducting appropriate means of assessment for those leaving school, including those going on to tertiary institutions. There is a clear implication that testing and selecting are likely to continue in some form (Victorian Universities and Colleges Committee, 1974).

The Victorian Secondary Teachers Association gave notice in 1970 that it would campaign for the abolition of HSC by 1975. The history of this campaign can be followed in the Association's journal, *The Secondary Teacher*, from March 1972 onwards. A summary of their

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case and a complete listing of their journal articles on this policy appear in a special publication (Hannan, 1974). The campaign for abolition of HSC has been associated with a demand for open admissions to tertiary education and a whole issue of the VSTA journal was devoted to this topic (*The Secondary Teacher*, March 1974). The debate reached its peak in the latter half of 1974, after the Annual General Meeting of the VSTA decided to call on all teachers to boycott HSC in 1975 (*The Secondary Teacher*, September 1974). This decision was reversed at a special delegates meeting on 1 December 1974. This means that teachers will continue to prepare students for HSC in 1975, but the campaign and the public debate surrounding it has left many doubts about the future of competitive assessment like HSC.

One article written in defence of public examinations was that by Fensham. He pointed out that not only were there many positive advantages in retaining and modifying HSC, but that elimination of HSC would not make the selection question disappear or bring about open universities and recurrent education. He saw a greater probability that the changes would take place in the reverse order with HSC fading away as a consequence of the availability of these educational alternatives (Fensham, 1972).

One of the most controversial aspects of the VSTA campaign was their suggestion that, where selection for tertiary entrance was necessary this should be done by a ballot of the applicants for the available places. This suggestion often appeared to be the focus of the debate, but Hannan presented the campaign as being aimed at more fundamental issues of educational philosophy. He expressed opposition to assessment for the purpose of rank-ordering, grading and sorting of students. Hence he was opposed to competitive selection based on academic performance. Academic barriers to education were seen as just as unacceptable as racial, religious or economic barriers in a democratic community. Hannan also tried to separate the educational decisions about open access to education from the community decisions about the availability of places for vocational training (Hannan, 1972).

Dunn was another writer who saw order-of-merit selection as the cause of educationally undesirable backwash effects on the school. He maintained that these effects would continue regardless of the type of examination used or the type of grading information collected. In his discussion of the interactions between society, the individual and the examinations, it is suggested that the needs of society are not necessarily served by selection according to academic criteria. Furthermore

the individual may be much better served by having test information made available to help him make a rational choice between the alternatives facing him as he leaves school. This article gives a very good analysis of possible types of data and the ways in which they can be used to meet different criteria (Dunn, 1974*a*).

It is the particular question of use of information for selection or guidance which Dunn takes up in another article. He argues a strong case in support of guidance and the development of appropriate tests for this purpose. If his conclusion that the inevitable decline in importance of syllabus-based examinations will be accompanied by a growing need for adequate guidance services is accepted, then this article sets out some of the steps which must be taken in developing syllabus-free tests and training counsellors and teachers for new roles (Dunn, 1974*b*).

Competitive selection for entrance to tertiary education has dominated the scene at the secondary–tertiary interface in Victoria for over thirty years, but now Malley questions whether selection is any longer the main issue. He quotes national data which show that the relative growth rate of enrolments in universities is declining and that projections for the 1981–86 period indicate a negative growth rate for tertiary enrolments. In Victoria, where the demand appears to conform to this national pattern, there are two new universities to be opened before 1980. Malley suggests that there could be an excess supply of tertiary places by the mid-1980s (Malley, 1974).

This excess supply is already evident in the fields of Engineering and some sciences. Many faculties in tertiary institutions in Victoria are not, in fact, engaged in competitive selection of students. In these circumstances it seems unlikely that student failure rates can be decreased by improving selection techniques.

At both the University of Melbourne and Monash University, the student counselling services have carried out pilot studies on identifying students at risk. Although these projects were quite different, they were both aimed at improving the performance of those students who were in danger of becoming failures (Cally, 1972; Priestley and Frederick, 1974). Like the Nisbet and Welsh project at the University of Aberdeen, these were attempts at reducing failure rates from within the tertiary institutions.

Cally suggested that those who believed that intellectual capacity was the dominant factor accounting for success or failure were clinging to a myth. The Monash University study showed that the student who failed

was likely to be more and not less intelligent than a successful candidate who had entered the university with a similar HSC score. Priestley and Frederick identified the failures at the University of Melbourne as 'underachievers' who were obviously in need of help. Many of these students responded to help given in group discussion sessions. These two studies and similar ones done in Western Australia (see Chapter 4) seem to suggest that students do not fail because they lack intelligence. It seems unlikely that the problem of the underachieving student will disappear as a result of refining the testing, rank-ordering and selecting process.

Looking back over this review of approximately one hundred and sixty books and articles it seems monotonously repetitious. The same low correlations, poor predictions, high failure rates, criticisms and suggestions seem to recur over a period of thirty to forty years. Much time, money and effort has been devoted to the problem of improving selection yet our university failure rates have remained stubbornly resistant to all attacks. The more recent work gives cause for hope that, as the pressures for selection decline, the focus of attention will move away from institutions towards individual students. An adequate system of guidance before entry and a program of identification and intervention for those at risk after entry could prove a more humane approach to the problem of failure. It remains to be seen whether these proposals will bring about more efficient use of tertiary education resources and less wastage of human potential.

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APPENDIX A

LIMITATIONS ON PREDICTION: SOME PROBLEMS OF MEASUREMENT AND STATISTICS

The effect of cut-off and rejection of portion of the sample between the measurement of predictor variable and the measurement of criterion variable is discussed by many researchers. The article which most writers refer back to is one written in 1939 by Taylor and Russell. This sets out the effect of cut-off on validity and the effect on success rate of shifting cut-off lines. Tables are included giving the proportion who will succeed out of those selected for given cut-off ratios and given correlation coefficients (Taylor and Russell, 1939).

Hughes applied this theory to the problem of selection based on examination scores as practised in Australia (Hughes, 1959).

Lumsden has made a very neat and concise statement of a number of factors which lead to lower correlations. He concluded by suggesting that we should give up the myth of prediction and stop the proliferation of useless studies (Lumsden, 1959).

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APPENDIX B

BIBLIOGRAPHICAL REVIEWS AND LITERATURE REVIEWS

In addition to some excellent bibliographies attached to some of the articles discussed in this book there have been some articles published which are specifically designed as bibliographical reviews or literature reviews. Sanders has produced a very comprehensive review of the literature up to 1953 (Sanders, 1953). Naomi Caiden concentrates on the Australian literature and covers the period up to 1964 (Caiden, 1964).

Miller gives a more general coverage in the reference lists in his book (Miller, 1970*a*), but he also published a discussion of the research literature and other studies on higher education in Australia and New Zealand (Miller, 1970*b*). Both these publications list many relevant references for this topic.

Choppin and Fara have produced an annotated bibliography covering a large number of publications, mostly dating from 1960 onwards. They concentrate on material from Britain, but one chapter deals with work in other countries (Choppin and Fara, 1972).

Two recent articles, one by Sumner in Adelaide and another by Smurthwaite of Melbourne, summarize the research findings from a select list of reports relevant to the specific issues of assessment and selection in the present context (Sumner, 1972; Smurthwaite, 1973).

In a review of a number of research articles related to student performance at tertiary level, Cooney also discusses the methodology and interpretation of evidence in these studies. He points out some limitations on this type of research and the latter part of his paper, particularly the section on statistical procedures, should be read in conjunction with the articles referred to here in Appendix A (Cooney, 1974).

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With the rapid expansion in tertiary education in the last thirty years, testing and selecting for entry have become major issues. This literature review attempts to place these issues in context, showing their historical background and their development in relation to the changing pattern of tertiary education.

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